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The AMERICAN RIFLEMAN

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THE 1923 PALMA

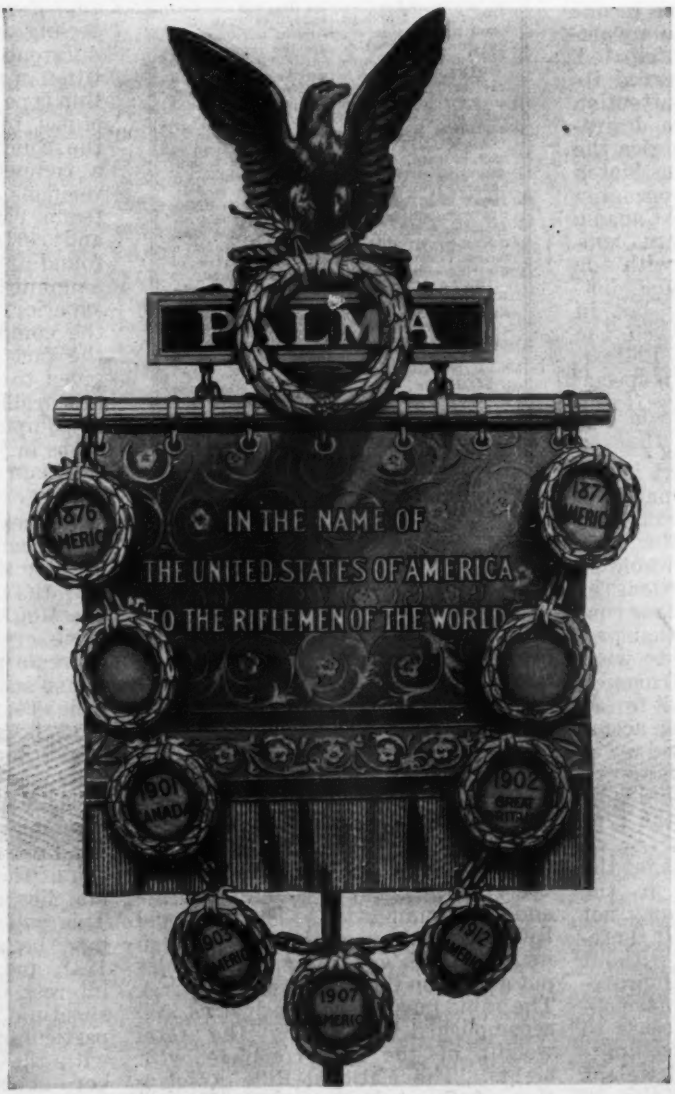
By Maj. K. K. V. Casey
Capt. *U. S.* Team

HOW many teams can we expect to participate in the 1923 Palma?

This is the paramount question to be answered in connection with the revival of the historic long range match at Camp Perry this year. Beside it, all other questions become relatively unimportant except in so far as they may encourage—or discourage—the attendance of other rifleman nations who in the past have contributed toward making the Palma a marksmanship classic.

The Palma conditions under which the 1923 event will be held, removes all handicaps which European competitors have felt were to be found in former arm and ammunition specifications; therefore the important remaining essentials for making the Palma revival a success lies in attracting a sufficient number of entrants to provide keen competition and in placing a strong United States team in the field to defend our title of World Champion won in past Palmas.

The United States team, according to present plans, will defend the Palma trophy at Camp Perry on Saturday, September 22. As the selection of the Team and whatever practice the Team is to get will have to be prior to that date, the question of the selection of the Team and the subsequent practice will mean that from the conclusion of the National Rifle Association Matches until the Palma Match very little time can be devoted to either the final selection of the Team or team practice.



THE PALMA TROPHY which means more than any other to the riflemen of English speaking nations.

The Team will be selected as heretofore, that is by the scores made in the regular N. R. A. Matches at 800, 900 and 1,000 yards, followed by a two days' tryout over the Palma course. To get in this amount of shooting, and at the same time allow the different competitors full opportunity for practice for the National Match, for participation in the National Individual Match and other events that will take place the week of September 17-22, will require some skillful engineering on the part of Col. Mumma, but as this is the type of task that he delights in, no difficulty is anticipated on that score.

The United States Palma team this year will be what the riflemen of the nation make it—a winner or a looser, according to the support which is given it in the way of team material. The participation of European and Canadian teams, however, rests upon a different basis. It is up to us, who are sponsoring the revival to create in them a desire to participate and to convince them that they will shoot under handicaps no greater than those under which our own shooters will labor—in short, that they will get an even break.

Much can be done in this respect—and has been done by making the conditions of the match fair to all.

When the conditions of the original Palma were laid down in 1876, it called for a two days competition, that is once over the Palma course each day for teams of eight men, using Match rifles, these conditions being practically identical with the conditions of the Elcho Shield, one of the historic trophies of the National Rifle Association of Great Britain.

At the time of the revival of interest in long range shooting around 1899 and 1900, when the Palma trophy was resurrected, it was decided at that time by the newly re-organized National Rifle Association to change the conditions of the Match to call for the military arm of the respective countries and reduce the number of shots to once over the course in one day. The Match in 1900 was a walk-over, as no foreign teams participated. This walk-over, however, served its purpose as it attracted the attention of Canadian riflemen to the desirability of their coming to America the following year for the Palma Match shoot, which they did so thoroughly by taking the Palma trophy to Canada.

In 1901 no other foreign teams competed but in a competition with the same number of shots and same distances as the Palma trophy but in which match rifles were allowed, the Ulster Rifle Association of Belfast, Ireland, sent a team over for a special competition with the New Jersey State Rifle Association.

Match rifle shooting at long ranges occupies a very important part in the annual matches of the National Rifle Association of Great Britain, and it is believed to be to the best interests of the game as a whole to revert to the original conditions of the Palma, in so far as the rifle is concerned. The different ideas that prevail in different countries as to what constitutes the military small arm do not necessarily in all cases call for an arm that either in sighting or accuracy of shooting could be looked on as a target weapon but by opening the competition to match rifles there is no governmental restriction on the type of weapon used.

Match rifle shooting encourages the development of refinements in the shooting game that may or may not have certain military value. It therefore is clearly indicated that without certain limiting factors, improvements brought about in the development of match rifles would cease to be of value. There are but two limiting factors: First, the total weight of the weapon; Second, the size of the cartridge. It is but common sense to realize that a soldier cannot carry a weapon of over a certain weight, and also that the number of rounds of ammunition that can be carried by the soldier in battle is limited by the weight per round. The question might be asked "Is it not possible that the results of development of Match rifles, irrespective of the above factors, would have application?"; the answer being, "To a limited extent only," as with no limit on the weight it would be possible to develop rifles with such heavy barrels as to make barrel vibration negligible, and yet barrel vibration is one of the greatest difficulties to overcome in preserving the balance between a military rifle and its ammunition. The National Rifle Association of Great Britain in its conditions governing match rifles put a limit on the weight of the barrel. The same purpose can be just as well accomplished by giving the total weight of the rifle complete with sights. The National Rifle Association of Great Britain also places a limit on the caliber of the cartridge. A much simpler method is to place a weight limit on 100 rounds of any ammunition used.

CONDITIONS FOR THE PALMA TROPHY MATCH

Long Range Team Championship of the World. Established 1876.

WHEN FIRED: Saturday, September 22, 1923.

TEAMS: Each team shall consist of eight men. Members of the various teams must be citizens and residents of the countries they respectively represent, except in case of a team representing a provincial territory of a government, in which case the resident of a province will be sufficient.

RIFLE: The National Army weapon of any nation represented in the competition, or any rifle of private manufacture, may be used provided its total weight including all appliances does not exceed eleven pounds.

AMMUNITION: Any fixed ammunition may be used, but it must not be of a dangerous character and the total weight per hundred rounds must not exceed 7¼ pounds. In all cases of accident arising from defective ammunition the user shall be held responsible. No allowance will be made for a defective cartridge except in the case of a misfire. Any bullet leaving the muzzle of the rifle will be counted as a shot fired.

DISTANCES: 800, 900, and 1,000 yards.

NUMBER OF SHOTS: Two sighting shots and 15 record shots by each competitor at each distance. Coaching allowed.

POSITIONS: Any without artificial rest.

TARGETS: Two targets will be allotted to each team.

SIGHTS: Sights of any description may be used. The only colors allowed on the sights are black or white, or black and white, but not mixed so as to produce gray. Orthoptics may be worn if desired.

TIME: Two hours will be allowed for each distance, exclusive of time allowed or challenging.

TRIGGER PULL: At the commencement of the match the triggers will be tested with a 3-pound trigger tester, the barrel being held vertical.

TRIAL SHOTS: A separate target will be assigned each team for trial shots.

ENTRANCE FEE: $15.00 per team.

RICOCHETS: In the absence of any positive indication (by the throwing of earth or other substance into the pit or against the target) that a shot is a ricochet it will be allowed and its value scored. In the event of an unavoidable delay for which the competitors are not responsible one sighting shot may be allowed at the discretion of the committee of umpires and executive officer. No rifle may be cleaned or wiped out between the shot fired with it at any single distance of the competition.

PRIZES: First, the Palma Trophy, emblematic of the Long Range Team Championship of the World, to be held for one year or until the next competition, and medals to the individual members of the team. Bronze medals to the members of all other teams competing.

In order to overlook nothing which may give the greatest latitude to all competitors the question of arms and ammunition has also been approached from another angle; that is to allow the different teams to use the standard rifle of any nation. This would give them an opportunity to use the Springfield rifle, if they so desire, as there is a feeling in a great many places that from the standpoint of target accuracy, at least, the Springfield rifle has no superior today. I believe in the great International Matches held at the rifle range at LeMans that most of the foreign teams used the U. S. Springfield rifle.

As the principle underlying international competitions of all types is the development of more friendly feeling between the peoples of the different nations, and as every competition of any sort tends to bring about this type of good feeling, the principal object to be accomplished is to hold the competition and try to make it a competition of men rather than weapons. Of course, if competing teams elect to use a certain weapon and certain ammunition, and it is found afterwards that the weapon or ammunition used by another team is superior, that does not detract from the competition as such, in view of the fact that equal opportunity was given to all to use the best that was procurable, and mistakes in selection of equipment are on a par with mistakes in judgment on the selection of the team or the shooting of the team.

It is sincerely hoped that by some means or other sufficient foreign teams can be induced to come to this country this year for the Palma shoot and the mere fact that long range shooting has not been encouraged in some of these countries should not serve to prevent a team entering, as the splendid showing of the Argentine Rifle Team in the Palma Match in 1913 is a shining example of what can be done by any team on their first attempt in a long range International.

The year 1923 gives American riflemen an opportunity to make this year a banner one in rifle shooting by reason of the fact that the International Matches are to be held in this country. This will be the first time that they have been held in this country since 1913, and, coupled with the increased interest that is being taken in rifle shooting throughout the country, particularly among civilians, together with the increased interest in small bore shooting and the support given to rifle shooting by Congress, makes the conditions unusually favorable for a successful meet.

A Tale of Two Rifles

By
Capt. E. C. Crossman

THE gob carefully raised the loaded Model 1903 and snuggled his cheek to such portion of that service stock as a man can reach with his cheek, and looked through the rear peep and poked the front sight up against the tummy of the black bull 200 yards away. His position being off-hand, he proceeded to follow the said bull through its dizzy gyrations and finally at an instant when it had apparently stopped to flirt with the front sight, he pressed the trigger for the first shot of the morning.

Whereupon the earth rocked, the heavens shook, and to quote our best fiction writers, there was an inferno of sound, which evidently means in the language of the proletariat, a hell of a noise.

According to the spectators, when they finally ran down and halted the shell-shocked sailor, he was a hundred yards to the rear and still going, clutching firmly in one hand the butt stock of what had once been a service rifle in all the pride of its full gunhood; in the other hand the barrel and forestock portion, the twain entirely separate each from the other.

The parts intermediate, trifling details such as receiver, bolt, magazine and so on were absent and unaccounted for.

Admiring the relics a week or so later, not having been one of those present, I came to the conclusion that I had never seen such an enthusiastically and unanimously busted rifle in all my experience of rifles wrecked purposely and otherwise.

John Siefert's photographs leave little to the imagination, like most of John's pictures, but I may add that the rifle was completely blown in two, barrel and those parts normally attached to it, including the forestock, in one portion, butt stock, guard, floor plate and magazine spring and follower forming the other. The bolt, a few fragments of receiver, the separate extractor and some slivers of wood, were gathered up around the place where the six-inch shell had apparently exploded.

The receiver acted much as a glass receiver would behave if violently assaulted with a sledge, broken off short at the bolt stop pin under the bridge, the bridge itself obliterated, the threaded hood or receiver ring two-thirds gone, and the barrel itself left with its threaded portion bare, ready to screw into another receiver.

Strange to say, the sailor firing the rifle was practically unhurt and was back firing on the range within a day or so. Had he been firing prone, the tale might have been not so pleasant to tell.

The bolt lugs were intact, although showing signs of battering which might have been done while coming into violent contact with receiver parts on the way out and of course showing the usual signs of gas cutting and brass plating commonly found on bolts of rifles letting go in this fashion.

The rifle was one of those in use by sailors from the U. S. S. Mississippi and possibly other ships, encamped for rifle practice on the militia range near Los Angeles.

Naturally the little incident put something of a chill into the assembled civilian and other rifle shooters, which as usual lasted for as much as a half-hour or so.

Anyhow the range wagged on pretty much as usual, and the sailors continued to have a fine time whanging away at the targets and doing bunk fatigue in between times and now and then cleaning up the rifle club just for practice.

Then, about a week later another gob with another of those specially selected relics the Navy is transporting around in the armories of its pre-Jutlands, proceeded to take his stand for the first shot of the morning at the 200-yard target, like the first gob, in the off-hand position. Pretty soon he touched her off. The term is well chosen, he touched her off all right, and some of her is apparently still going.

When the smoke and the dust cleared away, and the pieces quit coming down, and the spectators returned from behind the adjacent trees and rocks and the 200-yard butt which some of them, including Bill Murphy, so I am informed, had made in three and two-tenths seconds, there appeared a wreck about like the one of the week preceding. It differed in minor details, such as that the bolt was blown only 31¾ yards instead of 35 yards, etc., but in the main it represented the most expeditious and complete taking apart of a service rifle anybody had ever seen, barring only that of the week before.

Happily the sailor was unhurt, proving once more the truth of the old saying that a cherub sits up aloft to watch out for the life of poor Jack.

It was at this stage that friend Ned Cutting wrote me at the beach that if I would put in an unaccustomed and unusual appearance on a rifle range once more, particularly that rifle range, I would see something of much interest to me as a person somewhat familiar with the service rifle.

I did—and I was interested all right.

The details of these two totally wrecked and disrupted service rifles, which only by the Lord's mercy didn't kill or badly maim the jackies shooting them run like this:

Rifle No. 597,521, Springfield, barrel date February, 1915.

Rifle No. 658,132, barrel date April, 1917, also a Springfield.

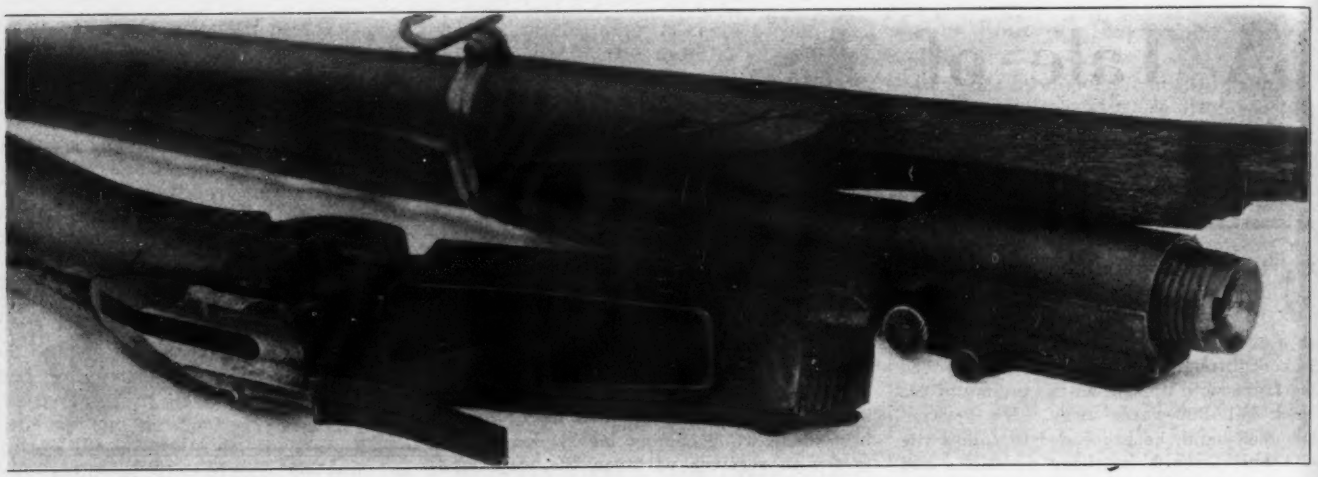
Ammunition Remington Lot E-1242, 1918, loaded with U. S. Pyro, Lot 1094.

It was a war lot of 150 gr. bullet, similar to a million rounds or so of the same make which was sent to us at Camp Perry, Ohio, in 1918, marked "For target practice in U. S. only," which meant that it had not passed the requirements for overseas.

The ammunition being used by the sailors, however, was not so marked, and evidently had graded as A-No. 1.

The cases which had been fired in the blown-up rifles had naturally disappeared as completely as the evidence in some of these bootleg cases. Other cases picked up around the range showed unmistakable signs of brittle condition, splitting at the heads, and in two instances while I was on the range a half day, spitting gas back into the face of the shooter.

The lot which we had at Camp Perry was defective in precisely the same way, in fact I used them for testing rifles for function, such as heating and locking tests, as contrasted to some Winchester ammunition we had which was as soft as the Remington was hard. The soft Winchester case would lock a rifle shut on small provocation, and firing 15 rounds per minute, would let a rifle function about two minutes. Sometimes the case would smear over the bolt-head like a brass pancake, locking the rifle, and in two instances reported to me as experimental officer, let go and blew gas back into the shooter's face. These cases



The rifle was completely blown in two, barrel and those parts normally attached to it, in one part; butt stock, guard and magazine forming the other.

would have worked fairly well in machine guns, although too soft even for that type of weapon.

On the other extreme was the very hard Remington case, working delightfully easy in the rifle because of the high temper and tendency to release itself from the chamber walls, but too hard, and dangerous to the eyes of the shooter if not to the rifle.

The factories cannot well be blamed for such slips, they were grinding out ammunition at the rate of thirty millions a day or more for one plant alone, and doing their level best to make up for the asininity of an administration which was both to proud to fight and too damn pigheaded to get ready for the eventualities which anybody but a Democrat could see were threatening if not certain.

So I obtained samples of the ammunition and sent them back to the DuPont Co. for test to see if possibly the hurriedly-made and water-dried powder, the process terim since being made.

The letter of the DuPont Co. follows: being somewhat new, had developed any tendency to break down and possibly produce high pressures, in the five years in-

February 1. 1923.

Copy to—Mr. F. W. Bradway, Director.
SMOKELESS—Sporting Powder Sales Div.

INFORMATION FOR CAPTAIN E. C. CROSSMAN.

1. The five rounds of Remington 1906 .30-Cal. Ammunition of 1918 loading, forwarded by Captain E. C. Crossman, have been examined and tested.

2. The Remington Arms Company advised that this ammunition was loaded with Pyro, U. S. Lot No. 1094, and the retained sample at Brandywine Laboratory was subjected to chemical tests, with the following results:

German Test—5 hours.

Methyl Violet Paper Test—25 minutes.

3. The loaded ammunition was tested with results as follows: The first round was fired as received in a heavy 2-piece pressure gauge and gave a pressure of 43,400 lbs., sq. in. The powder from the second cartridge was transferred to Frankford Arsenal components and fired in a heavy 2-piece pressure guage where it developed a pressure of 45,500 lbs. The second, third and fourth rounds were broken down and measured, with results as shown in the following table:

Weight in Grains				
	Powder	Bullet	Cartridge	Shell
	47.1	150.7	400.0	202.2
	46.6	150.7	399.0	201.7
	46.0	151.0	398.0	201.0
AVG.	46.6	150.8	399.0	201.6

Diameter in Inches					
	Rim	Base	Shoulder	Neck	Bullet
	.4674	.4656	.4310	.3358	.3082
	.4685	.4664	.4310	.3354	.3080
	.4700	.4660	.4310	.3358	.3082
AVG.....	.4686	.4660	.4310	.3356	.3081

Length in Inches			Crimp Test
Cartridge	Shell	Bullet	Lbs.
3.316	2.490	1.075	187
3.325	2.485	1.075	115
3.325	2.490	1.055	172
AVG..... 3.322	2.487	1.068	158

The powder from the third and fourth rounds was then transferred to Frankford Arsenal components and tested in the combination velocity and pressure gauge, with the following results:

Velocity F. S.	Pressure Lbs./Sq. In.
2592	49,100
2610	47,300

The fifth round was fired as received in the combination velocity and pressure gauge, where it developed a velocity of 2571 f. s. and 44,400 lbs. pressure.

4. There is a gun correction of 19 f. s. to be added to each velocity. Your attention is called to the high crimp test and variation in weight of charge in the breakdown of this ammunition.

5. Several of the fired cases forwarded by Captain Crossman were split near the head and showed marks of an expansion strain where the split occurred. There were no split cases obtained on any of the five rounds fired at this Laboratory in either of the guns used, which would indicate that this split was caused by an abnormal chamber or excessive head space.

6. We do not feel that either the Brinell or scleroscope tests on cartridge cases is of much value. More valuable information could be obtained by cross-sectioning these cases and examining them under a misroscope, but as there is no metallurgist at this Laboratory we are unable to do this.

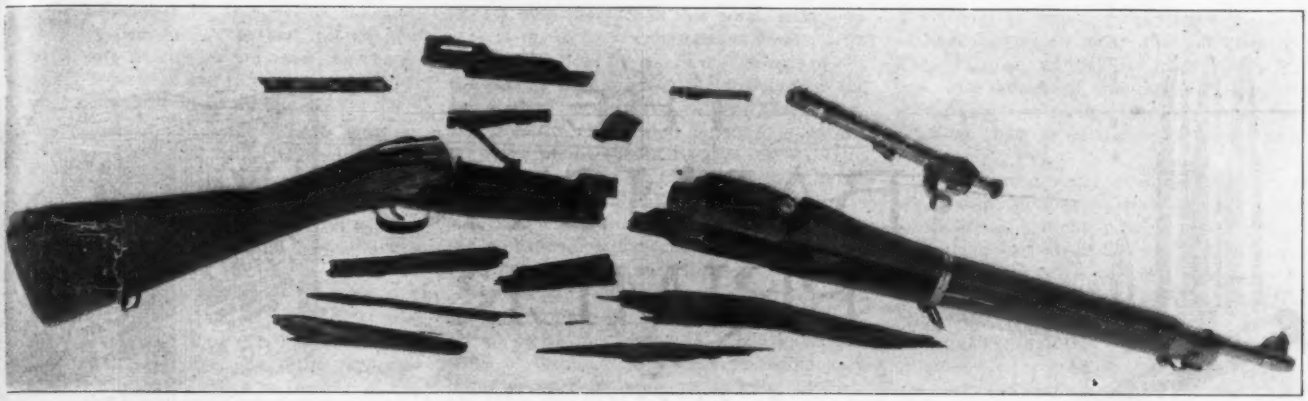
BRANDYWINE LABORATORY,
By: S. V. L.
WHC:MRB
04

All of which seems to absolve the ammunition from any charge of high pressures, in fact both pressure and velocity are sub-normal, the velocity being about 2,600 ft. instead of 2,700 ft. which had also been reported by Frankford in making their routine surveillance tests.

What was not normal was the high "pull-out" or crimp test shown, roughly two to three times as high as it should have been. In a normal chamber without grease I do not think this could have any effect because the case neck expands laterally and releases its grip on the bullet.

The clue seems to lie in the remark of the DuPont Co. that "several of the fired cases forwarded were split near the head, and showed marks of an expansion strain where the split occurred. There were no split cases obtained in any of the five rounds fired at this laboratory in either of the guns used, which would indicate that this split was caused by abnormal chamber or *excessive head-space.*"

Investigation demonstrated that in each instance the wrecking shot was the first of the morning. This would naurally give rise to a chorus of "Ah-ha's," on the part of the gun-wise persons, but I have con-



When the smoke cleared away and the pieces quit coming down, there appeared a wreck about like that of the week preceding.

fidence that nothing was left in the bores of the rifles to cause the wrecks—excepting possibly a little oil or grease which might have acted as a lubricant and aided in the backthrust on the bolt. Some of the sailors were National Match shooters, among them the old timer A. E. Wells, and they were not likely to make the same mistake twice, if they made it even once. Both shooters told me that they had wiped out their rifles before firing and inspected the bores. Even with a disposition as happy-go-lucky as that of a sailor and a nerve that let the same men go right back shooting the next day, the Navy men were not likely to overlook any bets after seeing the first rifle, because that was enough to give chills to a member of any suicide club.

I do know that my old friend, Bill Murphy hurriedly advertised a rummage sale on all of his rifles with receiver serial numbers under 800,000 after seeing the first flat-foot wreck—and nobody ever thought that Bill was lacking in nerve.

What the investigation did develop, however, is well worth noting on the part of those shooters who have been in the habit of taking liberties with the fact that the parts of our service rifles are pretty much interchangeable, and the chief reason for writing this story for the paper.

The sailors, like most hard-boiled rifle shots, had been swapping bolts around to get easy working ones in their pet rifles. Neither departed rifle wore the bolt with which it had left the Armory many years ago. There were naturally no head-space gauges in the outfit—if there is a pair in the U. S. Navy—and the head-space in those ancient and honorable pre-war receivers was probably any old thing, both because of the trading around of the bolts, and because of the usual wear and set-back of both the lugs on the bolts, and the receiver shoulders.

The chamber of neither barrel showed signs of a pressure sufficient to wreck the rifles as they were wrecked, had the cause been pressure alone. A matter of excess pressure alone would have meant around the 100,000 lb. mark, and you do not fire this in a service rifle as a rule without leaving some signs in the chamber.

Old shooters do not need to be told what head-space means, some of the new ones do. Inasmuch as ignorance of the possibilities of switching bolts or barrels without having the rifle tested might deprive some chap of his rifle or injure him, I go into the matter a trifle in detail.

A rim cartridge such as the Krag, is stopped by the rim striking the breech end of the barrel in the countersink duly provided.

A rimless cartridge such as the 1906, 8 mm., etc., is stopped in its forward progress by the shoulder—the taper from body to neck—striking the corresponding shoulder in the chamber. The entire distance from this chamber shoulder to the face of the bolt is the head-space.

If it is too short, which rarely occurs, the cartridge cannot be loaded home, or if it can be, there are produced queer wrinkles in the case on firing.

If it is too long, often produced by switching bolts, and sometimes by constant wear and upset of an old bolt or an old receiver, the case is thrust forward to the limit of the chamber by the slam of the closing bolt and in position ready for firing, does not rest against the bolt-head. You will remember that when the trigger is pulled a pressure is developed in all directions inside of the case of about 50,000 lbs. per square inch of case area.

If the case has not already been thrust forward the blow of the firing pin against the primer accomplishes the result. One of two things may happen.

If the chamber is perfectly dry the gas thrust drives the bullet forward, the thin forward walls of the case against and into the minute rough spots of the chamber walls, and the rear of the case backward until it strikes the supporting bolt.

Inasmuch as the thin walls are locked for the instant firmly to the chamber walls, and the rear of the case is unsupported, the result is often a fractured or separated case at a point from a half to three-fourths inch forward of the cannelure, the broken rear end driving back against the bolt, the forward portion locked against the chamber walls.

It is a very common trouble in machine guns, which develop head-space from the constant wear and hammering of the parts or incorrect assembly or new barrels. To obviate this as far as possible, and to prevent separation of the case by the violent extraction, machine gun cases are made soft and free to stretch a trifle.

If the chamber contains grease, or even a thin film of oil, the explosion is unable to lock the case walls against chamber walls, and it merely drives the entire case to the rear against the bolt-face, a hammering action if it is only a short one.

It is a dangerous condition, and exists more often than shooters suspect if they have been swapping around here and there, and saving a pet old bolt to use in a new barrel and receiver.

The old German gunsmith, Wundhammer, once brought out to the range a sporting Springfield, which he had fitted up with a Poldi Anticorro barrel, and asked me to shoot it for him.

The first shot developed a nice ring around the case about a half-inch from the cannelure, the second shot resulted in a completely separated case, and the third shot, after we had poked out the broken portion by dint of wedging an empty into it and driving both out together, broke off one bolt lug, and cracked the other nearly through.

It was at this point that I stopped firing the rifle, fearing that if I kept on some little trouble might turn up.

This rifle was merely a victim of head-space, or more correctly speaking, excess head-space. The old gentleman had fitted his new barrel to the best of his ability but the little matter of a few thousands inch had been overlooked.

The first Savage .250-3,000 sent to me for test in 1913, a year or so before they were put on the market, proceeded to break off the second case fired in it. I took a

Continued on page 18

THE BALLISTIC PRIMER

by

J. C. GRAY

PART 2—POWDERS and CASES

AMONG those confirmed rifle cranks who load their own ammunition, the matters of a suitable kind and charge weight of powder are constant sources of question. The queries on this subject which have been received by *Arms and the Man* have led to the publication of a little book, and even it doesn't contain all the dope.

So the next step, after making up a design for a bullet is to establish the powder charge and to estimate what type of powder will probably give the best results.

It may be of interest to take a look at powder in general and see what it is. Practically everyone knows that smokeless powder differs very materially from black powder, but just what the difference is does not seem so clear.

Black powder, for centuries used as a propellant charge for projectiles, was invented or discovered so long ago that we are not sure who was the very first to use it. However, from the beginning it was made of about the same things and in the same proportions as it is today. Specifically, black powder is a *mixture* of saltpeter, sulphur and charcoal the usual proportions being 75-10-15. These proportions were varied in accordance with the results desired but even so, the black powder was always a mixture of combustibles with a separate oxygen carrier.

On the other hand, smokeless powder is usually a rather complex mixture of compounds in the chemical meaning of the word compound as distinguished from a mixture in which there is little chemical combination, and the combustible and oxygen are in the form of a compound, such as nitro-cellulose.

Smokeless powder is a colloid mixture of compounds of nitrated substances. Now what does that sentence mean? First, the word "colloid" means "resembling jelly or glue," "uncrystalline" and "capable of but slow diffusion." Compound, in the chemical meaning of the word, implies an intimate association of the elements present to form a substance having a uniform molecular form. For example, if we mix sugar and water, the result is a mixture without chemical change in either, but if we mix cotton and nitric acid we have a chemical change and a resultant different from either.

The basis of most American small arms powders is nitro-cellulose or "gun cotton." In 1845 Schonbein discovered that when ordinary cotton was treated with a mixture of nitric and sulphuric acids a powderful explosive was produced. However, the rate of burning of this substance was so rapid that it could not be used for guns, and it was not until about 1886 that a process was devised which made the rate of burning of this compound easy to control. The process referred to is that of "colloiding" the nitro-cellulose with ether and alcohol. In this manner a substance somewhat resembling glue in consistency is produced, which can be squeezed through a press in strips or rods and cut off to any length desired. Rifle powders are made in various size perforated grains to provide for proper time of burning, the burning time being controlled by the length of the grain and the diameter and thickness of the web. One interested in the matter of explosives cannot do better than to consult the book "Explosives" by Arthur Marshall, published in 1917 by C. Blakiston's Son & Co., Philadelphia.

At first powders were made with a considerable percentage of nitro-glycerine in them, but this substance, while producing a very uniformly burning powder, is so hot that it is very hard on the gun barrel. As a result of this the pure pyrocellulose powders, which are considerably cooler in burning, have been lately much more extensively used.

Going back to the matter of choosing a type of powder for the cartridge under consideration, it would seem advisable to take a pyrocellulose powder of suitable size, such as is manufactured by the E. I. duPont de Nemours Company, of Wilmington, Delaware. There are other powders available, notably the products of the Hercules Powder Company, but as the data required for determining the size is available with the duPont product, this will be selected.

Looking over a number of test charts, it is found that Powder IMR 17½ fired from a rifle, Caliber 250-3000, charge 35.5 grains, gave a mean pressure of 49.180 pounds per square inch with a bullet weighing 110 grains, and an instrumental velocity of 2650 foot seconds. The same bullet, with a charge of 38.5 grains of IMR 15½ had an instrumental velocity of 2691 foot seconds, and the pressure was 46,260 pounds per square inch. It will be seen that the latter charge gave the higher velocity, with lower pressure. It would seem advisable, then, to choose the latter type powder and to fix the charge tentatively at 38.5 grains.

Of course, this is not the way a charge would be selected if no firing data were available. In such case, it would be necessary to assume a factor of efficiency of the burning of the charge which would give a measure of the available energy for doing work on the bullet. In the case of the rifle, the energy available for imparting velocity to the bullet is about one-third the total energy of the charge. Then, with the muzzle energy required for imparting a velocity of, say, 2700 foot seconds to the bullet, and knowing the total energy available in a pound of powder, it would be possible to calculate the weight of charge required and to design the powder grains to burn so as to fulfill this requirement as to efficiency. This is much too long and complicated a process to more than indicate in such a paper as this. Those interested in the subject are referred to the book by Colonel Tschappat, of the Ordance Department, U. S. A., on "Ordance and Gunnery."

Now that the weight of the charge under consideration has been set, at least tentatively, we may proceed with the design of the cartridge case, and from that to the chamber of the rifle.

In considering the matter of interior ballistics, one of the items of great importance is what is known as "Density of loading." The term actually is an expression of the relation between the weight of a given volume of water equal to the volume of the powder chamber and the weight of the powder charge. For instance, we may take the volume fo the caliber .30, Model of 1906 cartridge case at .25 cubic inch. A cubic inch of water weighs 252.9 grains (approximately). If the cartridge case will hold .25 cubic inches of water and the weight of this is 63.3 grains, and if the charge of powder weighs 50 grains, then the density of loading would be

$$D = \frac{50}{63.3} = .789$$

which is about the figure for the present ser-

vice cartridge, but by reason that the cartridge is loaded for a constant velocity, as different lots of powder are used, the charge will vary somewhat and in this way the density of loading will also vary slightly.

This matter of density of loading must be carefully watched, as it will be found that the pressures generated by a certain type of powder with one density of loading and a given projectile will be different with another density, though the weight of projectile and powder charge remain the same.

Going back to the matter of the case now under consideration, it is noted that the 250-3000 case will hold about 42 grains of water, in volume being .167 cubic inch (approximately). Thus the density of loading of the charge of 38.5 grains of powder was

$$\frac{38.5}{42} = .916$$

which is about the figure for the specific gravity of smokeless powders poured into a vessel and very lightly shaken down. This will vary from .91 to about .97, so it will be seen that the charge practically filled the case. Considering that brass is costly and that it is desirable to use all the space required, and no more, for containing powder, the volume of the .25 caliber case under investigation will be taken as equivalent to 42 grains of water, or about .167 cubic inches.

In the drawing (Fig. 2) there is shown a case which has a computed volume of .167 inch and, while of course it was borne in mind that this volume was desired, this time the first trial happened to hit—a little variation above the figure named would have done no particular harm, but as it came out that way it will be so shown.

In the figure it will be noted that the dimension of the head of the case just forward of the cannelure is 0".45, the 250-3000 case, which is practically the U. S. Caliber .30, Model of 1906 necked down and shortened is 0".47 (approx.) at this point. Why make a change? The answer is that the change from the larger case is 0".02 and, considering that the total bolt head thrust is dependent on the area of the case, as much reduction as possible will be proper. For example, the bolt head thrust in the Springfield will be found to be between say, 10,000 and 12,000 pounds. Every bit which can be taken from the area of the case will tend to reduce this figure. The Savage case has just about the same area as the service case, and if, for example, it is desired to design a semi-automatic rifle, the matter of a small bolt head thrust is of considerable advantage. On the other hand, if the diameter at this point were made still less, then there might not be sufficient metal to properly support a primer as large as is desirable.

The 250-3000 case is about 1".9 in overall length, and has a sharp shoulder next to the neck. This sharp shoulder is necessary in a rimless case, because it is really the controlling factor in seating the case in the chamber of the rifle. It is better, from the point of view of getting as much out of the powder as possible with a minimum of erosion, to have a long shoulder at this point, as will be seen in the 25-35 Winchester and 25-36 Marlin cases. The drawing shows a semi-rim, that is the case is positioned in the chamber by the rim bearing against the face of the breech, and therefore it will be possible to extend the slope of the shoulder under discussion to a considerable extent. This has been done, and it will be noted that the dimension is 0".3, which is nearly three times as long as the coresponding dimensions in the 250-3000 case and about twice as long as the Caliber .30 Springfield. Meanwhile, the overall length is 1".97, or only ".07 longer than the case referred to at the beginning. Of course, the slope of the case from the base to the neck is not so great as might be, and the criticism may be made that it will be hard to extract. The answer is that this slope is exactly the same as in the .25 Remington Auto, and there appears to be no extraction trouble with that rifle due to cases sticking.

The head of the cartridge looks queer, it is cannelured, but the groove is radically differin shape from the usual form. The reason for the peculiar shape of the groove is, this being a semi-rim case, the use of a box type magazine requires that the top cartridge shall slide over the one below without catching. If the groove were approximately square in section, then the rim of the upper cartridge might catch in the groove of the lower and cause a jam. With the head designed as shown

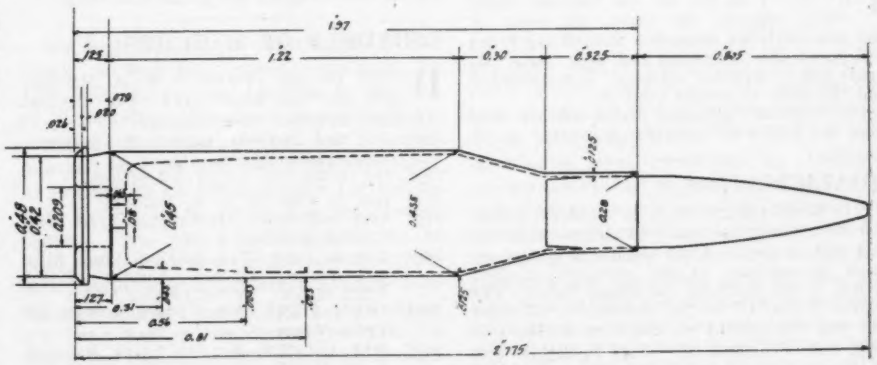


Figure 2

such a jam could not occur, as there is no place where the rim could catch and hold in the lower cartridge. But why have a cannelure? Why not have a plain rimmed case? A plain rimmed case does not work so well in the magazine, and there must be sufficient space for the extractor to grip the cartridge. Otherwise the extractor might slip over the small rim and cause a jam when the next round was pushed forward.

The primer seat in the design shown is of the size required for the regular caliber .30 Springfield primer. As had been found by experience, an ample flame is required for the ignition of modern powders, and the regular size being satisfactory in this respect, it has been selected to go in this design.

This matter of primers is of "primary" importance. In fact, without a satisfactory means of starting the powder to burning it would be an impossibility to build rifles, or cartridges to go in them, as they are made today. Yet how little thought or attention is given by the average rifleman to that tiny part of the cartridge on which depends the success or failure of his shot.

The primer is made up of a container, or cup, for the priming mixture, an anvil to detonate it on, and the priming mixture itself. In foreign cartridges the anvil is usually a part of the cartridge case, but this makes reloading an impossibility, and as there is a considerable use of reloaded ammunition in this country, the usual form of our cartridges provides for the anvil in the primer cup.

A recent article in *Arms and the Man* points to the conclusion that a very considerable part of the rifleman's trouble with rust is due to the fact that potassium chlorate is used as part of the priming mixture. On burning, this substance changes to potassium chloride, is used as part of the priming mixture. On burning, this substance changes to potassium chloride, which is similar to common table salt and is very hygroscopic—that is, takes up water readily. If some substance could be found to take the place of the chlorate of potash which would leave a less harmful residue in the barrel it would be quite a step in advance. Some experiments have been made along this line and one of the well known cartridge companies makes a caliber .22 rim fire cartridge which is believed to contain little or no chlorate.

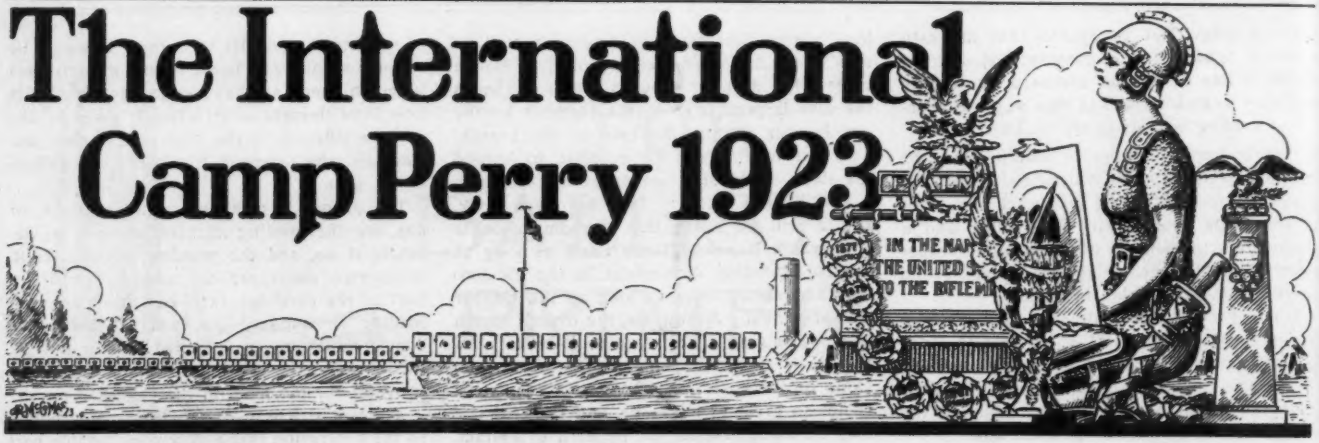
The following table hows some of the compositions which have been used for primer mixtures:

	U. S.	Eng.	Austrian
	%	%	%
Mercury Fulminate	.	19	13.7
Potassium Chlorate	47.2	33.3	41.5
Antimony Sulphide	30.8	42.9	33.4
Glass Powder			10.7
Gelatine			0.7
Sulphur	22.0	2.4	
Mealed Powder		2.4	

It will be seen that all these compositions employ potassium chlorate, and there is a good reason, because it is very satisfactory,

Continued on page 19

The International Camp Perry 1923



ELIGIBILITY RULES

ONE of the most important changes in the regulations governing the National Matches for 1923 is the clause which has been inserted to provide that Service Teams only will be affected by the requirement that no men may be shooting members of the team who have attended two out of the three preceding National Matches. National Guard and Civilian Teams will still be required to carry 50 per cent. of their shooting personnel from among the ranks of riflemen who have never before attended a National Match. The remaining 50 per cent. however are not restricted.

COURSE OF FIRE

THE course of fire for the National Team Match remains the same this wear as last year with the exception that all rapid fire will be on the "A" target and slow fire at 200 yards will be strictly "off-hand," arm extended and the sling in parade position.

The National Individual Match will be fired over the National Team Match course.

QUALIFICATION

CIVILIAN riflemen will be rated as Marksmen, Sharpshooters, and Expert Riflemen and will be awarded the regular War Department decorations on the strength of their scores in the National Individual Match. The change from "D" to "A" targets for all rapid fire and the barring of the sling in the off-hand position has necessitated a modification of the qualification scores required. The score required for rating as Marksman will be 200, for Sharpshooter 230, and as Expert Rifleman 255.

THE DEWAR MATCH

THE Dewar Trophy Match is fired by a team of 20. It represents the small-bore team championship of the world. The British, Canadians, and Australians fire on their home ranges and the American team fires at Camp Perry, Ohio. The team is selected in open competition from among the small bore rifleman on hand at Camp Perry and membership on the team represents the most cherished goal of the .22 shooters in this country. The try-outs for the Dewar 1923 Team will be fired September 15th and 16th. The high 25 competitors will be designated as the Team and will engage in team practice in connection with the other small bore matches on the program until September 23rd when the match will be shot.

The course of fire is 20 shots at 50 yards and 20 shots at 100 yards for each of the 20 firing members of the team. Metallic sights only are permitted in this match. All scores count for record. Colonel C. E. Stodter, who captained the victorious 1922 team, will again lead the International Small Bore outfit this year.

C. M. T. C.

MEMBERS of the N. R. A. who are planning on attending the various Civilian Military Training Camps will be interested to know that teams will be selected from each corps area Civilian Military Training Camp and sent to Camp Perry for the entire period without any expense to the team members. This is an opportunity for some good riflemen to get to the International Matches who might not be able to make the grade otherwise.

SCHEDULE OF MATCHES

DATES for the various N. R. A. Matches have not yet been fixed. The general schedule, however, is as follows:

Sept. 1st and 2nd—Assignment to quarters, cleaning equipment, etc.
Sept. 3rd to 8th—School of instruction.
Sept. 10th to 17th—N. R. A. Matches.
Sept. 18th and 19th—International Free Rifle Championships.
Sept. 20th to 22nd—National Individual Rifle and Pistol Matches. National Pistol Team Match. United Service Match.
Sept. 24th and 25th—Team Practice, National Team Match.
Sept. 26th and 27th—Record Firing National Team Match.

CIVILIANS

NO CIVILIAN teams will be sent to the matches this year at government expense. The School of Instruction and matches are, however, open to any citizen of the United States, without any expense other than transportation and meals. A special fare concession, enabling N. R. A. members to return from Camp Perry to their homes at one-half the original fare has been granted by all passenger traffic associations east of Chicago and the Mississippi. It is expected that similar concessions, or tourist rates, will be granted by the lines west of the Mississippi. The cost of meals will amount to about $1.25 per day. Rifles, ammunition, and sleeping accommodations will, as in the past, be furnished without charge. It is anticipated that at least a half-dozen complete civilian teams will be on hand, while preparations are being made to accommodate 250 or 300 individual civilian competitors, some of whom will attend the School of Instruction and N. R.A. Matches, while others will attend only for the matches.

FREE RIFLE CHAMPIONSHIP

THE International Free Rifle Championships of the World, held under the auspices of the International Shooting Union have been held yearly since 1898 with the exception of the years 1915 to 1920 both inclusive. In 1921, with the resumption of the matches at Lyons, France, an American Team was, for the first time, sent abroad to challenge the right of the Europeans to claim a World's rifle title, and for the first time since 1898 the Swiss met defeat. It was a real shock, not only to the Swiss but to all Europe but was accepted as one of those accidents that will occur in the shooting game. When in 1922, the American team repeated its victory at Milan, Italy, the Swiss went home with tears in their voices and blood in their eyes. It is fortunate for the reputation of America that the American Team this year will be equipped with rifles just a little better, will shoot ammunition just a little better, and will fire under mental conditions just a little better, than the team of 1922 because there is no reasonable doubt but what the Swiss team which will be on hand at Camp Perry this year will be the finest that the little mountain republic of riflemen can select, that it will be equipped with the finest rifles and ammunition that a nation of gunsmiths can turn out, and that it will make a supreme effort to wipe out the stain of two successive defeats.

Try-outs for places on the International Free Rifle Team will be held in various parts of the country between August 1st and 15th. From these preliminary try-outs men will be selected and sent to Camp Perry, Ohio. Another preliminary try-out will be held at Perry for the benefit of men attending the Camp who were unable to get to the regional try-outs. The candidates selected from all preliminary try-outs will then compete in a final elimination contest and the successful riflemen will make up the American International Free Rifle Team which will face the task of once more defeating a thoroughly aroused Swiss Nation. Dates and places of the regional try-outs and of the Camp Perry try-out will be announced later.

The match is fired at 300 metres on the International 300 metre target. There are no restrictions as to the rifle. Metallic sights only may be used. Five firing members constitute the Team. Each man fires 40 shots kneeling, 40 shots standing, and 40 shots prone. The high individual score over the course constitutes the Individual Championship. The high individual score in each position constitutes the Individual Position Championship for that position.

Major L. W. T. Waller, Jr. U. S. M. C., who piloted last year's team through its morale breaking trip to victory at Milan will again captain the team.

Correcting the Shooter's Vision

By F. C. Baldwin
and E. W. Stork

A new type of decentered focal axis which will solve the vision problems of many riflemen and hunters.

OUR friends of the medical profession assure us that nature provides a form of anaesthesia which materially lessens and often entirely averts the physical agencies which one would suppose must be suffered by the victim of a violent accident. I have been wondering if this prenomenon may not have some analogy to that very human characteristic of subconscious self-delusion which causes us to deny the evidences of advancing years and to indignantly refute all suggestions that our primal senses no longer function as in our more youthful days. Is the answer to this question physiological or psychological? Is it merely a manifestation of the human weakness of vanity?

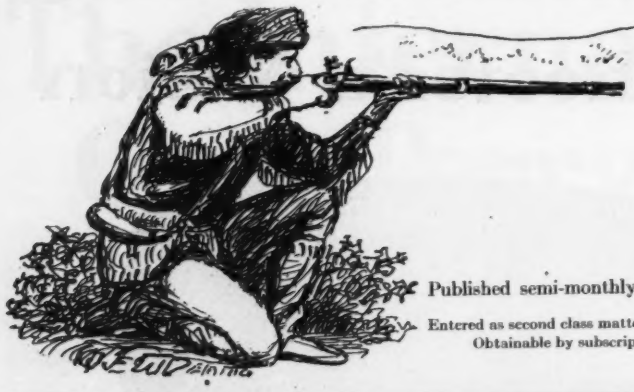
Thus I have attempted to analyze the causes of the profound and sudden shock with which I discovered that my shooting vision had become completely warped and unreliable. The shock was great and, for the moment, I was plunged into an abyss of despair, as it seemed that for me it sounded the knell of all sporting activities; that for me the end had indeed come.

The immediate cause of this alarming conclusion was the sudden and unexpected discovery that, after a hiatus of a good many years, during which I had had no opportunity to take my rifle afield or upon the range, there appeared to be a serious distortion in both the front and rear sights of my rifle, so serious as utterly to prevent any degree of accuracy in shooting. I had always worn glasses, but in my earlier hunting days the necessary optical correction had never been sufficient to prevent my being an average marksman. With the changes of time, however, had come changes of lenses and it was not until I had made definite plans for a new trip this year after big game and had a new rifle specially built for the occasion that I awoke to the realization that everything was askew and that I could probably not hit a grizzly in a vital spot unless he were standing on his head and leaning against a tree. After I had reacted from the first shock of this discovery, a saner philosophy caused me to remember that after all it was but egotism to imagine that I was the only hunter whose years were more than fifty and whose vision was defective. I reasoned that this problem must have been met and solved by others and it was up to me to discover how they had done it.

My first sep was to consult Mr. E. W. Stork, a technical expert employed by Edmonds, the leading optician in the city of Washington. Mr. Stork immediately assured me that the problem was a simple one and that his firm had made something of a specialty of fitting glasses for marksmen in the U. S. Army and the Marine Corps. This was gratifying and we at once set to work to solve my personal problem. By dint of much experimenting with the actual rifle it was found that, when my head was in the correct position for firing, the imaginary line extended through the front and rear sights struck the right lens of my glasses at a point very near the rim in the upper left-hand area, or at about "ten o'clock." Now, the prismatic distortion of my ordinary lens at that point was very great and I found that the small round aperture of the rear sight became an elongated elipse and was tilted to the right at an angle of about 45°. In like manner, the knife blade of the front sight was tilted at a similar angle. Mr. Stork stated that this would all be corrected by the simple process of decentering the lens so that focal axis would occur at the desired point, or about "ten o'clock," instead of at the usual or normal center of the eyepiece. So far, excellent! We would then have a pair of glasses scientifically calculated to give perfect satisfaction,—*on the rifle range.* Then I had another vision, a different kind of vision. I pictured myself, having with great care and difficulty maneuvered for an advantageous position wherefrom I could deliver the first and, let us hope, the last telling shot into a fine big specimen of ursus horribilis. Up to this point I had, of course, been wearing my ordinary glasses for normal or field vision, and must now change to my shooting glasses, for, be it remembered that the process of decentering the focal axis of the latter had rendered the remaining field of the lens utterly worthless for normal uses and sure to result in a severe headache if worn for any length of time. It was therefore necessary for me to make an expeditious change of spectacles and I pictured my doubts as to whether Mr. Grizzly would wait and my uncertainty as to whether he would make a clean get-away or come over and assist in the search of my pockets for the desired glasses.

M. Stork confessed that this raised a problem with which he had never before been confronted, as his task had hitherto been confined to making glasses solely for use on the rifle range. Realizing that my need was for a lens with two separate centers of vision, he explained the technical or practical difficulties of the case, stating that the art of lens-grinding had not yet been perfected to a point which made it possible to grind two centers, *of the same prescription*, upon a single lens. This must not be confused with the very common bi-

Continued on page 21



The American Rifleman

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A Wide Open Palma

BY REVERTING to original Palma conditions, which specify "any Match rifle" and adding thereto "or the military arm of any nation," the way has been cleared for the participation of all rifle shooting nations in the long range classic which is scheduled to be shot at Camp Perry, September 22.

The long hiatus which broke the series of Palma competitions after 1913, and which it is hoped will terminate this year, was the result mainly of a feeling among other competing nations that the conditions which specified the Military rifle of the nation competing gave to the United States with its super-accurate Springfield an insurmountable advantage over those nations whose army rifles were capable only of reaching war-accuracy standards. There were, of course, other contributory reasons, such as the intervening of the World War and later the red toll which the war took from the ranks of England's and Canada's finest riflemen; but both the Canadians and the British were good sportsmen enough to have entered the contest with the personnel available, save that they felt all effort would be nullified so long as they were forced to depend on the British service rifle.

In revising the conditions so that any contestant may use either rifles of match vintage or of any military design, subject to such reasonable limitations of weight of rifle and ammunition as will preserve the spirit and the practical phases of the match, the United States has placed all possible competitors on an equal footing with favor to none and has gone the limit in making the Palma a wide open event and a contest of man rather than merely a test of weapons. The publication of these conditions three months in advance of the competition will permit every other nation ample opportunity to organize a team and, if anything, obtain more training than will be possible in the case of the United States team since the personnel of the defenders of the trophy cannot be determined until within a few days of the time the match will be shot. To change the conditions of so historic a competition as the Palma is a serious matter and one which could be justified only by the exigencies of a situation which threatened a shooting classic with extinction. The alternative, however, in this instance demanded summary action in order to save an event which already had suffered ten years' desueitude.

The Palma and the other international matches will not be the only features at Camp Perry to attract riflemen. The National Rifle Association of America has announced that membership in the British, the Dominion of Canada and other rifle associations will be recognized for eligibility in entering N. R. A. competitions. This means that with the exception of a very few events which are specifically limited to citizens of the United States—notably the Wimbledon and Leech Cup Matches, and the President's Match—the full N. R. A. program for service and small-bore rifles and handguns will be opened to visitors.

When the Palma is revived at Camp Perry, a record number of competitors should be on the firing line. This long range classic, although dormant for a decade, is regarded both here and abroad as the paramount test of team marksmanship and if anything of greater importance to the English speaking peoples than the International Free Rifle competition. In conditions and tradition the match stands for the type of rifle shooting which normally and logically appeals to the American rifleman and to his British and Canadian cousins, and provides a common ground upon which to foster international good fellowship. For these and other considerations, such as the stimulus given the production of super-accurate long range weapons both here and abroad, the Palma Match is worthy of earnest and whole hearted perpetuation.

Will there be any National Matches?

WHEN American citizens write to the National Rifle Association and the outdoor magazines inquiring, "Are there going to be any National Rifle Matches this year?" there is something wrong.

The inquirers are certainly not members of the National Rifle Association, which may be considered as one of the things wrong with them, because every member of the National Rifle Association has already received an invitation to attend the matches at Camp Perry this year, but most of the men who are writing are undoubtedly acquainted with riflemen who are members of the N. R. A., or possibly are members of rifle clubs. Certainly they read their newspapers. The reason that individual riflemen are wondering whether there will be any National Matches this year is due, primarily, to the fact that individual members of the N. R. A. are not, all of them, talking up the National Matches to their fellow-townsmen.

Press dispatches are being sent out regularly in Washington, but they will not be run by local editors unless there is local demand for the news.

There will be National, and International Matches too, this year. That is not news to you, of course, but from a number of inquiries it is evident that it will be news to a lot of riflemen who are at least mildly interested.

Individual Instruction in Rifle Practice

By Col. A. J. Macnab, U. S. A.

Part 4

SECTION VII

Effect of Wind—Sight Changes—Use of Score Book

41. *Wind.* *a.* With the exception of wind, weather conditions have practically no effect on the bullet up to 600 yards. Beyond 600 yards the effect is slight, but it is well for the expert shot to understand the influences of the different atmospheric conditions and the corrections to be applied. In firing at 600 yards or under, the effect of the weather conditions (except that of the wind) on the bullet can be disregarded. The influence of wind must be carefully studied.

b. The horizontal clock system is used in describing the direction of the wind. The firing point is considered the center of the clock and the target is at 12 o'clock. A 3 o'clock wind comes directly from the right. A 6 o'clock wind comes straight from the rear. A 9 o'clock wind comes directly from the left. A wind that is constantly changing its direction back and forth is called a "fishtail wind."

c. The force of the wind is described in miles per hour. The force of the wind is estimated by throwing up dry grass, dust, or light paper and watching how fast it travels, by observing the danger flags and by the mirage. In general, a light breeze is a 5 to 8-mile wind; a fairly strong breeze is a 10 to 12-mile wind. Wind blowing 20 miles an hour is very strong.

d. Wind from either side blows the bullet out of its path. This must be allowed for by moving the rear sight toward the wind by means of the wind gauge. The worst kind of a wind in which to shoot is a fishtail wind at 12 to 6 o'clock. The amount the bullet will be blown from its path depends on the force and direction of the wind and on the distance to the target.

e. The amount of windage to allow for the first shot is shown in the wind gauge diagram in the score book. It can be found approximately by applying the "wind rule."

f. After the first shot is marked, the correction necessary in windage is found by referring to the ruled targets in the score book showing the windage correction for each range. Windage corrections can be also estimated by applying the windgauge rule given in paragraph 43.

42. *Wind rule.* *a.* The range (expressed in hundreds of yards) multiplied by the velocity of the wind and divided by 10 equals the number of quarter points to allow for a 3 o'clock or 9 o'clock wind.

Example: At 500 yards the wind is blowing 8 miles per hour at 3 o'clock $\frac{5 \times 8}{10}$ (4 quarter points) or 1 point of windage. The sight should have been one point of right windage for the first shot.

b. As the direction of the wind gets nearer and nearer to 12 or 6 o'clock, the amount of windage necessary becomes less and less. Winds one hour away from 3 and 9 o'clock require only slightly less windage. Winds one hour away from 12 and 6 o'clock require almost half as much windage as 3 or 9 o'clock winds.

c. Winds that are at 12 o'clock require no windage, but it is a very rare thing to have a steady wind from either 12 or 6 o'clock. Strong winds from 12 o'clock tend to retard the bullet a little and from 6 o'clock tend to accelerate the bullet, but the amount is so slight that a correction in elevation is very seldom necessary.

43. *Wind-gauge rule.* *a.* One point of windage moves the point of impact of the bullet 4 inches for each 100 yards of range. Thus one point of windage will move the hits 8 inches at 200 yards, 12 inches at 300 yards and 20 inches at 500 yards. This rule is not exact but near enough for all practical purposes.

b. The point of impact of the bullet will move in the same direction as the rear sight is moved. For example: If it is desired to move the hits to the left, the rear sight must be moved to the left; if it is desired to make the hits strike lower and to the right, the rear sight must be moved down and to the right.

44. *Mirage.* *a.* Heat waves that can be seen near the ground are called "mirage." The direction in which these waves are blowing and their speed are watched by good riflemen in judging the direction and velocity of the wind. The mirage is of assistance in judging the wind principally on bright days when there is a light, variable breeze.

b. In a moderate wind, the waves seem to race across the range and to lie close to the ground. In a light wind the waves do not lie so close to the ground and appear to move more slowly. In strong winds the mirage can not be seen.

c. When there is no wind or when the wind is at 12 or 6 o'clock, the mirage seems to boil. The "boiling" of the mirage signifies that the wind is changing direction. The firer should wait until the mirage begins a steady flow from one side or the other before firing.

d. Mirage can be seen much better with a field glass or telescope than with the eye alone.

45. *Elevation rule.* *a.* Changing the elevation 100 yards at any range will give a change on the target, in inches, equal to the square of the range in hundredsof yards .

Example: At 200 yards, changing the elevation 100 yards makes 4 inches change on the target; at 300 yards, 9 inches; at 500 yards, 25 inches; at 600 yards, 36 inches. This rule is not exact but near enough for all practical purposes.

b. The horizontal lines in the model targets in the score book also show how much change to make in the elevation at each range. When a change in elevation is necessary it is best to consult the model target in the score book before deciding how much of a change to make.

46. *Light.* *a.* Light has no effect on the bullet but does affect the aim. The effect of changes of light is very slight with most riflemen. The correction for variations in light does not exceed 25 yards in elevation at any range. The effect of changes of light is not uniform in its effect upon the aim of all riflemen.

b. As a general rule, men unconsciously aim a little lower in a poor light than in good light and consequently need more elevation when the light is poor. This lowering of the aim is due to the fact that the outline of the bull's-eye is not distinct in a poor light, therefore, men can not hold as close to the bull's-eye and still be sure of their aim. As a rule, poor lights exist on dark days when there is a haze in the air; on very bright, warm days when there is a decided mirage; and when the sun is back of the target. The best light for shooting is when the sky is uniformly overcast and there is sufficient light to see the target clearly.

c. Sunlight from one side has the same effect, with most men, as wind from that side. This is because the side of the front sight toward the sun is more clearly defined and unconsciously held under the center of the bull's-eye. Such holding places the bullet on the opposite side of the bull's-eye from the sun. The allowance of windage for sunlight varies from zero to almost one-half a point. In making this allowance the sight is moved toward the sun.

47. *The zero of a rifle.* *a.* The zero of a rifle for each range is the point at which the rear sight must be placed, for both elevation and windage in order to hit the center of the bull's-eye on a normal day when there is no wind. This zero may not conform to the marks on the sight leaf and the wind gauge. The zero of any one rifle may differ with different men owing to the difference in their way of holding the rifle, or of aiming.

b. Each man must determine the zero of his own rifle for each range. He does this by studying the data which he has written in his score book concerning sight settings, sight changes, light and the direction and velocity of the wind. The zero of a rifle is best ascertained on a day with an overcast sky when there is no wind. Having learned the zero of his rifle, the rifleman computes

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all his windage and elevation allowances for the first shot from this zero and not from the zero marked on the rifle sight, unless the two correspond.

48. *Canting the rifle.* *a.* If the rifle is canted the bullet will not hit exactly where the rifle is aimed. Even unskilled shots, however, cant the rifle but very slightly and the effect on the strike of the bullet is correspondingly slight. The mistake of ascribing a wide 4 or a 3 to a slight cant of the rifle should not be made.

49. *Shooting up or down hill.* In shooting either up or down hill less elevation is needed than when shooting on the level. The steeper the hill the less elevation is needed, so that when firing vertically up or down no elevation at all is needed, no matter how distant the target. Slight slopes that may be found on target ranges have no appreciable effect upon the elevation used.

50. *Sight-sitting and sight-changing exercises.* In these exercises the instructor uses the full size A, B and D targets, with spotters to indicate the position of the hits.

a. The instructor assembles his squad or group, each pupil having his rifle, score book and pencil and conducts the exercise as follows:

(1) Points out the wind-gauge and explains that each line or division represents one point of windage.

(2) Points out the graduations on the sight leaf and explains that the line directly under the number represents the range.

(3) Explains the effect of wind and cautions the class to disregard all atmospheric influences except wind.

(4) Explains the wind-gauge diagram in the score book.

(5) Reads over and explains the wind rule, wind-gauge rule and the elevation rule. By asking questions he assures himself that these rules are understood.

(6) Explains the horizontal and vertical lines on the "model targets" in the score book and assures himself that each men understands the use of this diagram.

(7) Shows the pupils how to draw the elevation and windage lines for each range on the blank targets of the score book upon which they are to plot their shots during range firing.

(8) The above points having been explained to the assembled group, the pupils are placed in pairs. The instructor tests the ability of the members of the class to set the sights for the first shot by use of the wind rule or the wind-gauge diagram. Every time the sights are set each pupil examines the sight of the pupil paired with him and tells the instructor, when called on, the sight setting used.

(9) Instructor tests ability to change sights intelligently after first shot by referring to the horizontal and vertical lines on the model target.

b. Examples: (1) "You are at 500 yards and estimate the wind to be 10 miles at 3 o'clock; set your sights for the first shot. Jones, what does Smith's sight read? Robinson, what should the sight read? Each man whose team mate did not set his sight at 1¼ points right windage, hold up his hand." The instructor, by questions and explanations, assists the men who have made mistakes.

2. "You are at 600 yards and estimate the wind to be 10 miles at 9 o'clock. Set your sights for the first shot. Suppose you fired and the spotter marked the hit here (placing a spotter in the 4 space near the bull's-eye at 3 o'clock) and you were sure your hold and trigger squeeze were good; change your sight to bring the next shot into the center of the bull's-eye. Johnson, what does Williams' sight read? Snider, what should the sights read? Each man whose team mate did not have his sights set at 2 points left windage, hold up his hand."

c. The instructor assists those men who have made decided errors. Differences of less than ¼ point are matters of opinion in applying the rules and are unimportant.

d. The instructor gives a number of examples with the wind at different angles and velocities and at the various ranges until the class thoroughly understands the use of the wind-gauge.

e. Following the instruction in the use of the wind gauge, the instructor puts the class through similar exercises which require changes in elevation.

f. The instructor gives a number of examples which require changes in both windage and elevation until the principles of sight changing are well understood by the class.

g. Assume the zero of the rifles to be away from the normal, both as to windage and elevation and repeat the exercises.

h. Example of other sight-setting exercises:

(1) "Set your sight at 625 yards with 1¼ points of left windage. Suppose you fire four shots hitting here (place four spotters in the bull's-eye) and your fifth shot goes here (place spotter on 3 space at 11 o'clock). Jones, what are you going to do? Jenkins, what are you going to do? You should not do anything to the sights. It is practically certain that you squeezed the trigger improperly and flinched. Not even a very sudden and violent change in the weather or light could cause nearly that much of a difference. Don't try to correct your own faults by changing the sights around."

(2) "For your first score in rapid fire at 200 yards you have set your sight at the same elevations and windage that you used in slow fire. Suppose this to be 200 yards elevation and your zero windage and your group goes here (putting 10 spotters low and to the left). Set your sight to bring the next score into the figure. Miller, what does Wright's sight read?" etc.

i. A group in rapid fire should strike the same place as in slow fire. Rapid-fire groups that vary in position from slow-figure groups are due to imperfect trigger squeeze in rapid fire and consequently these groups are more scattered. Men should endeavor to squeeze the trigger so that the rapid-fire sight settings will be the same. But if there is a constant variation in the two sight settings, each man should note it in his score book and set his sight in rapid fire so as to make the groups count as much as possible. Groups that are scattered all over the target can not be corrected by changing the sight.

51. *The use of the score book.* *a.* Each man must keep a score book in which he records not only the value of the hits but the location of each hit, the sight setting and sight changes, the force and direction of the wind, the kind of light, the hour, the date and such other data as may be of use in the future. Spaces for these notes are provided on the score sheets on the score book.

b. The use of the score book on the range is important for the following reasons:

(1) The plotting of the shots shows the firer the location of his group.

(2) The wind-gauge diagram indicates the windage to take for the first shot. The model target shows by means of vertical and horizontal lines the change in elevation and windage necessary to place the group in the center of the target.

(3) Plotting the shots and recording the data as to light and wind helps the soldier to learn the zero of his rifle.

(4) The data written down as to sight settings and weather conditions while firing at any range are of great assistance in setting the sight correctly when again firing at that range. Where a number of scores have been fired and recorded, the firer should get his sight settings from previous scores fired on days that were similar as to light and wind.

c. The score book will be kept personally by the man firing. The coach assists him when necessary to decide what to write down, but the coach will neither plot the shots nor enter any data.

52. *Score-book exercises.* *a.* The squad or larger group is assembled in front of a full-sized B target, each man with score book, pencil and rifle. The class is divided into pairs. Each man acts as coach for the other man of his pair.

The instructor states the light and weather conditions and the range. He then indicates 10 successive shots on the target by means of a spotter and requires each man to plot each shot as it is indicated, write down the data given from time to time and make the actual sight settings and corrections on his rifle. Weather and light conditions assumed by the instructor and changes announced during the exercise should be such as are likely to occur on the rifle range.

b. The pupils are told by the instructor to open their score books at the first blank page and to plot the shots and to write in the data as given to them. They are further instructed to write lightly so that erasures may be made, allowing the same page to be reused. The example as given will be substantially as follows:

(1) "You are at 600 yards on the rifle range. You are getting ready to fire a slow fire score. There is bright sunlight. The wind varies from 8 to 12 miles an hour in

velocity and from 1 to 3 o'clock in direction. When you are in position ready to fire the first shot, the wind seems steady at 3 o'clock and blowing about 8 miles an hour. Write in your data and set your sights. Jones, where has Robinson set his sight? Williams, where has Smith set his sight? You should have a scant point and a quarter of right windage."

(2) "You fire your first shot and the spotter marks it here. (Put spotter a close 4 at 7 o'clock.) Decide what you are going to do and set your sights. Dodd, what does McLean's sight read? You should have moved your sight about one-fourth a point to the right and raised it 25 yards so that your sight should read 625 yards and a scant 1½ or a strong 1½ of right windage.

(3) "Your second shot goes here (spotter near center of bull's-eye); your third shot goes here (spotter in bull's-eye near the top); your fourth shot goes here (spotter in bull's-eye near the bottom); your fifth shot goes here (close 4 at 9 o'clock). The wind seems to be a little stronger, but you are not sure. You think your hold was all right, but you are not absolutely certain. Johnson, what are you going to do?" "I would take half the correction called for by the model target." "Set your sight accordingly. You should have about 1¾ points of right windage now. Your sixth shot goes here (a bull's-eye near the edge at 3 o'clock). Malone, what are you going to do? The four on the fifth shot must have been due to an error in aim or trigger squeeze, so put your sights back to where they were before (1½ points)."

(4) "Before you fire your seventh shot you notice that the wind has shifted to about 1 o'clock but still blowing the same rate. Wilson, where has Simpson set his sights now?" etc. "Billings, what does the book say about a 1 o'clock wind?" "You need almost half as much windage as for a 3 o'clock wind." "You should now have almost three-fourths point of right windage. Set your sights there."

(5) "Your next shot goes here (a wide 4 at 6 o'clock). Collins, what correction has Brown made for his eighth shot?" "You should have made no change in your sight. Your windage is apparently correct and there has been no change in the conditions. Your low shot was due to a poor aim or a poor trigger squeeze. Don't try to correct your personal errors by moving your sights around. Your eighth shot goes here (bull's-eye); your ninth shot here (bull's-eye); your tenth shot goes here (bull's-eye). Write in your notes and exchange books with your team mate. Smith, has Williams plotted all the shots correctly? Read the notes he has written in his book."

c. The instructor corrects errors and mistaken ideas and makes a note of the pupils needing additional instruction.

SECTION VIII

Fifth Step; Examination of Men Before Starting Range Practice

53. *Examination:*

(NOTE.—The answers given herein are merely examples. Men should be required to explain them in their own words.)

Q. What is this? (Drawing a circle on the ground or on paper.) A. A circle.

Q. Where is the center of it? A. (Pointing to the center.)

Q. Suppose that circle represents a peep sight which you are looking through and that you are told to bring the top of the front sight to the center of it; where would the top of the front sight be? A. Here (pointing to the center of the circle).

Q. Make a mark in the circle to represent the front sight. Make a small circle to represent the bull's-eye. Is the bull's-eye in the center of the peep sight? A. No; the bottom edge of it is in the center.

Q. Why? A. Because the top of the front sight is in the center and just touches the bottom edge of the bull's-eye.

Q. Should the front sight be held up into the bottom of the bull's-eye? A. No; it just touches the bottom edge of the bull's-eye so that all of the bull's-eye can still be clearly seen.

Q. What is this? (Indicating sighting bar.) A. Sighting bar.

Q. What is it for? A. To teach me how to aim.

Q. Why is it better than a rifle for this purpose? A. Because the sights on it are much larger and slight errors can be more easily seen and pointed out.

Q. What does this represent? A. The front sight.

Q. And this? A. The rear sight.

Q. What is this? A. The eyepiece.

Q. What is the eyepiece for? A. To cause me to place my eye in such a position as to see the sights in the same alignment as that set by the coach.

Q. Is there an eyepiece on the rifle? A. No; I learn by the sighting bar how the sights look when properly aligned and I must hold my head so as to see the sights the same way when aiming a rifle.

Q. How do you hold your head steadily in this position when aiming a rifle? A. By pressing my cheek firmly against the side of the stock.

Q. Where do you focus your eye when aiming a rifle? A. On the bull's-eye.

Q. Tell me what is wrong with these sights. (The instructor now adjusts the sights of the bar making various slight errors; first, to show the correct and incorrect adjustments of the sights, and then, with the sights properly adjusted he sights on the small bull's-eye to demonstrate correct and incorrect adjustments, requiring the men to point out any error.)

Q. What is the difference between the way you aim with peep sight and the way you aim with an open sight? A. There is no difference. In both, the top of the front sight is brought to the center of the circle. With the open sight, the top half of the circle is omitted, making it look as if the top half of the circle had been cut off and removed.

Q. Now, take this sighting bar and adjust the sights properly. (Verified by the instructor.)

Q. Now that the sights are properly adjusted, have the small bull's-eye moved until the sights are properly aimed at it.

Q. How do you breathe while aiming? A. After I get my sights lined up on the bull's-eye, I draw in an ordinary breath and hold it while aiming and squeezing the trigger.

Q. Take the prone position and aim and snap at that mark. (The instructor must assure himself that the man knows how to hold his breath properly while aiming. Many men have great difficulty in learning to do this correctly.)

Q. What is this? A. An aiming device.

Q. What is it used for? A. To show the instructor how a man is aiming.

Q. Now I will take this rifle and with the aid of the sand-bag rest to hold the rifle steady I will aim at the bull's-eye, and you will watch the sights through the aiming device and tell me when my aim is right and when it is wrong and what the error is when wrong. (The instructor now aims so as to illustrate the common faults and the man must observe and call attention to them.)

Q. I will now snap at a bull's-eye a few times and you will watch through the sighting device and call where the shots would have hit.

Q. Now take this rifle and using the sand-bag rest aim at the bull's-eye and I will watch you through the aiming device. (The instructor satisfies himself that the man understands sighting and aiming and requires him to snap a few times and to call his shots.)

Q. I will take the rifle and assume the kneeling, sitting and prone positions, and position with sand-bag rest and you tell me whether the position is correct or incorrect in each case. (The gun sling is adjusted in all these tests.)

Q. Take this rifle and show me your kneeling, sitting, and prone positions, and positions with sand-bag rest.

Q. Now show me how you take the sitting and prone positions rapidly from a standing position.

Q. How do you squeeze the trigger? A. I squeeze the trigger with such a steady increase of pressure as not to know just when the rifle will go off.

Q. What *do* you know while you are squeezing the trigger? A. I know that the sights are lined up on the bull's-eye.

Q. If the sights are slightly out of alignment, what do you do? A. I hold the pressure I have on the trigger and only resume the increase of pressure when the sights become lined upon the bull's-eye again.

Q. If you do this, can your shot be a bad one? A. No.

Q. Why? A. Because I can not flinch, for I do not know when to flinch and the sights will always be lined up with the bull's-eye

when the rifle goes off, because I never increase the pressure on the trigger, except when they are properly lined up.

Q. Is it necessary to take a long time to press the trigger in this way? A. No; the method of squeezing the trigger is slow at first but rapidity is developed by practice.

Q. How do you squeeze the trigger in rapid fire? A. I squeeze it the same way as in slow fire, with such a steady increase of pressure as not to know when the rifle will fire.

Q. In rapid fire how do you gain time so as not to be compelled to hurry in aiming and squeezing the trigger? A. I gain time by taking the position rapidly, working the bolt rapidly, and by keeping my eye on the target while working the bolt.

Q. How does keeping your eye on the target help you to gain time? A. A man who looks into the chamber while working the bolt always works it slowly so as to see the cartridges enter the barrel and he loses time in finding his own target again.

Q. What other fault in rapid fire comes from looking into the chamber while working the bolt? A. Firing on the wrong target.

Q. Show *me* how you work the bolt in rapid fire, prone, sitting and kneeling.

Q. Is it important to get in the correct position before beginning to shoot in rapid fire? A. Yes; even though it takes more time, I should always get into the correct position before beginning to shoot.

Q. What is meant by "calling the shot?" A. To say where you think the bullet hit as soon as you shoot and before the shot is marked.

Q. How can you do this? A. By noticing exactly where the sights point when the rifle goes off.

Q. If a man can not call his shot properly, what does it usually indicate? A. That he did not squeeze the trigger properly and did not know where the sights pointed at the time the rifle went off.

Q. What is this? A. A score book.

Q. What are these lines for? (Indicating the horizontal lines in the model target.) A. To show the amount of elevation necessary to bring the shot to the middle line.

Q. What are these lines for? (Indicating the vertical lines on the model target.) A. To show the amount of change in windage necessary to bring the shot to the middle line.

Q. If a shot hits here (indicating), what change in your sights would you make to bring the next shot to the center of the bull's-eye?

Q. What effect does moving your rear sight have on the shot? A. It moves it in the same direction as the rear sight moves.

Q. If you want to make the shot hit higher, what do you do? A. I raise my rear sight.

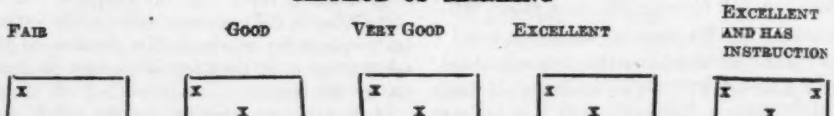
Q. If you want to make your shots hit more to the right, what do you do? A. I move my rear sight to the right.

Q. If you move your rear sight on point of windage, how much will it move the point struck by the bullet? A. Four inches for each 100 yards of range.

Blank Form to Show State of Instruction.

NAME	
	Sighting bar.
	Sighting and aiming with rifle.
	Triangle exercises.
	Blackening sights.
	Use of gun sling.
	Taking up the slack.
	Holding the breath.
	Positions.
	Assuming positions rapidly.
	Care and cleaning of the rifle.
	Trigger squeeze.
	Calling the shot.
	Bolt operation.
	Rapid fire.
	Sight changes.
	Effect of light and wind.
	Use of score book.
	Use of coach.
	Final examination.
	Gallery Practice.
	Pads.

METHOD OF MARKING



Q. Explain what you mean by that.

Q. I will place this spotter on this target (full size 500-yard target) to represent a shot properly fired by you at 500 yards with zero windage and sights set at 500 yards. Take your rifle and move your sights to bring the next shot to the center of the bull's-eye. (Instructor now tests in various ways the man's ability to make proper sight corrections.)

Q. What are the three principal uses of the score book? A. To show me where my shot group is located, to indicate how much change in the sights is necessary to move a shot or group of shots to the center of the target and to make a record of the sight settings of my rifle for the different ranges under various weather conditions so that I will know where to set my sight when starting to shoot at each range under different weather conditions.

Q. Tell me what effect different light and weather conditions have on a man's shooting.

Q. In firing at ranges up to and including 600 yards, what is the only weather condition for which you make sight corrections? A. Wind.

Q. What three things do you do in cleaning a rifle after it has been fired? A. I first remove the powder fouling from the bore. I then dry the bore thoroughly of the liquid used in removing the fouling. After this is done, I grease the bore to protect it

Q. How do you remove the powder fouling from the bore? A. By swabbing it thoroughly two or three times with cleaning patches saturated with water or powder solvent.

Q. How do you dry the bore? A. By running clean patches through the bore until it is thoroughly dry.

Q. How do you protect the bore from rust? A. By swabbing it thoroughly with a cleaning patch saturated with grease.

Handloading Ammunition

By J. R. Mattern

CHAPTER XVIII

MAXIMUM ACCURACY

REVELATION awaits the shooter who has never handloaded ammunition for the purpose of obtaining the finest groups from his gun. The principles governing accurate shooting can be stated briefly. Their practical working out, however, is a source of never-ending interest, even more absorbing than study of a new cartridge which promises unique performance. Progress in improvement of accuracy is always possible, but perfection is never obtainable. For example:

In a cove on the shore of a northern Michigan lake the writer one day met two boys with an old 25-20 rifle, a couple of cans of powder and a hundred bullets. They had their loading tools with them. All the afternoon they worked away, trying different combinations of powder and bullets, weeding out poor loadings—and getting more joy out of the game, perhaps, than is actually experienced by a winner of a Wimbledon cup match. They were developing skill of a high order, too, for with a pitted barrel and lead bullets they were shooting three and a half-inch groups at 100 yards with their best loads. And for example:

In the city of Washington, in the office of a justly famous shooting magazine, the blase editors were casting about for new and greener pastures, so to speak. In their time they had fired every gun made, with every cartridge made for them all, and had competed and won in the matches we read about, and naturally were slightly cloyed with shooting. And yet quoth one to another—"What we need is a quiet range in some secluded neighborhood. Now I've an idea for a special load in my 35-85 Summerfield rifle that will beat that last test winner."

"You're right!" exclaimed the other, jumping out of his swivel chair and running about the office excitedly. "And I know just the place. It's only 30 minutes out, on the trolley line and a good road, too. There's an old farm house hidden among trees as a firing point. We can get 300 yards in safety, with a steep hill behind. I've been wanting to see if I couldn't . . . . ."

The living spirit of American rifle shooting dwells big and vital with the handloader who seeks to improve accuracy of his amunition. He may be compelled financially to make each dime pay for twenty cartridges, as the boys were doing, or like the opulent editors, may spend a dime per cartridge. East or West, pioneer or metropolitan, he knows he is sustaining the nation and improving himself while he maintains his skill in shooting, and he gets a "kick" from this game which has nothing to do with recoil on the shoulder.

Let us examine this term 'ACCURACY" a little to see what it actually means, for various shooters have various ideas of the matter. There is the beginner, for instance, who has acquired his conception out of the air or from fiction or picture shows. He is sure that anything seen can be hit—in other words, a thread, a match stem, a button can be cut with bullet after bullet without limit so long as they are not too far away to be aimed at or so long as the supply of amunition lasts.

At the other extreme is the, well, let us say disillusioned beginner, the boy or man who has fired the first shots at 200 or 500 yards with a new rifle, only to learn that he would not be safe in promising to hit a small house every time. His rather hopeless state of mind is based on experience, more reliable than the average fiction, yet still without benefit of a knowledge of what causes a failure to hit the desired object.

Accuracy in shooting is a four-ply matter of amunition, gun, holding of the gun, and aiming eye. Each of these factors is composed of dozens or hundreds of small but vital details. Their ramification extends back through generations of invention and developments, refinements, study. It embraces literally thousands of details in the making of powder and primers, gun steels, and bullets, and in the training of men's heads and nerves and muscles. Watch a skilled rifleman shooting a fine group, and you see what is not an apparently simple operation brought down from barbarism, but the flowering of at least a century of effort. The result could not have been achieved before the present time. We have as much right to be proud of it as we have of a thoroughbred horse or dog descended from a long line of blue-blooded ancestors.

Accuracy of shooting with a rifle or shot gun is measured by the size of the group at stated ranges. Perfect accuracy would be to place all the bullets in the same hole. Actual measure of accuracy, at 200 yards with some of our less reliable hunting rifles, for instance, is a group two or three feet wide. At this same range, the Springfield army rifle of today groups its bullets within about a five-inch circle. It makes two and a half-inch groups at 100 yards with Frankford Arsenal amunition. The average hunting rifle of 30-30, 38-55, 32-Special, 38-40 and other such calibers up and down the list, will likewise come pretty near to making two or three-inch groups at 100 yards, although seldom makes better than 8-inch groups at 200 yards. The cartridges with short, blunt bullets usually are lucky to land their groups within 12 or 15 inches at 200 yards, while at 500 yards they group on something the size of a load of hay, but nothing smaller.

Short, blunt bullets sheer off irregularly in the air when they get any considerable distance from the gun. Of the older hunting rifles and cartridges, one authority has this to say: "The 38-56 was one of the most accurate; the 45-70-350 next, with the 40-82 and the 45-90 third, making about six or seven-inch groups at 100 yards. A 25-20 that would keep all its bullets in an eight-inch circle at 200 yards was a jewel."

The 1923 tests of 30-1906 amunition by the Government at Quantico, Va., established records of smaller groups than we ever saw before at long ranges. At 600 yards 150 consecutive bullets struck within a 12-inch circle. The average ten-shot group among these measured only seven and a half inches. At 1000 yards the average group was 19.3 inches high by about 14 inches wide.

All this Springfield 30-1906 shooting represented groups at 200 yards which would be little larger than one inch, and at 100 yards would consist of just one ragged hole. A 22 Long Rifle target at 100 yards which has ten or twenty consecutive holes in the two-inch ring is not a rarity, but is decidedly worth showing—but the full power Springfield will group into half of that same circle, and the same Springfield with proper reduced loads will do almost as well.

A 25-20 rifle in my cabinet will group first class 86-grain jacketed bullets into seven-eights of an inch at 50 yards, and will group the 87-grain Lubaloy bullets into three-quarters of an inch. The one-eighth inch of difference here will be explained farther along. The 45-70-500 will make possibles on bullseyes measuring one inch for each 25 yards range. One of the magazines recently reported a trial of a 45-120-550 Sharp's buffalo rifle, which with 100 grains of black powder placed six out of nine of its big slugs in a two-inch group at 100 yards. The other three were not far away, but we will discuss them, also, farther along. The same writer reported shooting groups from a 40-70-330 rifle at 100 yards of one and five-eights of an inch—after firing some six hundred trial shots to learn how.

The Pope muzzle-loading rifles in 38-55 and other similar calibers made record groups as small as *an inch and a half at 200 yards.* Mr. Pope often stated that he believed every one of three rifles would group inside two inches at that distance, and he guaranteed them to group inside two and a half inches. These rifles of course were loaded from the muzzle with special bullets, and are chiefly interesting today for what their method of loading teaches us in our present-day handloading. Their results practically can be duplicated with cartridge rifles, carefully selected and carefully loaded, and properly chambered.

Revolver and pistol groups at 50 yards are as small as two inches when made under exceptional conditions. The 1923 Government amunition test established groups of 2.45- in., which record was smaller than any obtained before with the 45 Colt's Auto pistol.

War amunition is much less accurate than Government match cartridges. It is a failure for 500 and 600 yard match shooting. Government Krag ammunition also is not finely accurate. A 300-yard group of 12 inches is about as good as you can do with either.

Whatever the ultimate of accuracy with a rifle, whether practically one hole at 100 yards, one inch or so at 200 yards, three to five inch groups at 500 yards, and 14 to 20-inch groups at 1000 yards—this or something larger, it can be accomplished when the four factors of amunition, gun, gun holding and sighting eye work together at their best. Rifles vary of course, yet exceedingly few are not capable of keeping all their bullets within the standard bullseye which measures four inches at 100 yards of range, with good amunition, and few shooters find themselves unable to acquire that amount of skill.

The error due to the eye can be measured and compared in an interesting way with the size of groups obtained, by means of the triangle sighting range. Fasten the rifle on a bench or across a heavy box firmly enough to prevent its moving when touched. Aim it at a moveable bullseye, and have someone move the bull about until you have it where the sights appear to be lined on it precisely, then have your helper mark that spot with a pencil point through a small hole at the center of the bull. Aim in this manner three times, at least. The "group" you get at 100 yards range, which likely will be triangular in shape, will probably measure less than an inch in diameter, sometimes even as small as a quarter of an inch, if you have perfect eyesight. Slightly defective eyes will give you "groups" up to an inch and a half, while with bad eyes you may get three- or four-inch groups. If you use a telescope sight in aiming, your "group" ought always to be less than a quarter of an inch across. Triangle sighting is instructive. Every shooter should try it, and every handloader should know his eye-error and compare it with the groups given by the amunition he loads. He may find that it leaves a spread within his groups of only an inch or two inches at 100 yards for which the amunition and other factors are responsible.

In theory a group made by five or ten or more shots should be more or less regularly circular. No one hole should stand out from the rest very much. Yet when we make a ten-shot group with any rifle and amunition except the finest, we nearly always find one, two or three of the bullets striking more or less away from the rest. They may be called off-shots, and the group made by the rest is called the normal group. This normal group idea is something a handloader must grasp. It should control his sight adjustment. It shows the possibilities of his gun.

Off-shots are caused by defects in bullets or in burning of powder, but usually by bullet defects. Those who have read Dr. Mann's books will recall how he explained the results of two defects, calling one the X error and the other the Y error. One of these errors of flight of bullets is caused by powder gases at the gun muzzle pressing out past one side of the bullet before the other side, tilting the bullet and driving it on a tangent from the line of the bore and of sight. This error is caused by the bullet's base being slightly oblique. For instance, a base only a hundredth of an inch off square with the long axis of the bullet might drive the bullet one or two inches at 100 yards off to the right or left or high or low. Nicks, dents and scratches in the base, particularly at the edge, allow the gases to escape by them before it gets by the true edge, and have the same effect. The burrs of metal pressed back by the lands of the rifling also catch gases unevenly, and cause this error in flight to some extent.

Our most accurate jacketed bullets made today, as for instance the Lubaloy bullets of 30 caliber which won the Government amunition tests last year, and all the various "Palma" 30-caliber cartridges, have the edges of their bases beveled to prevent the burrs from extending rearward past the edges. Pope muzzle loading rifles were loaded from the muzzles in order to have these burrs, if any formed, on the front of the bullet rather than the rear. Dr. Mann once mutillated some bullets from a lot which had been shooting into a two-inch group at 200 yards. Some he cut and filed on their points, and they made a 3-inch group. Others he filed just a little on one side of their bases, and they made an eight inch group.

It would seem that fine accuracy is possible only with bullets trued up absolutely on bases, in heavy dies or molds. The smoother the bases are, the more chance they have to escape from the gun muzzle with a true drive in the line of the bore.

The other error in flight which Dr. Mann described was due to bullets being unbalanced —that is, heavier on one side than on the other. In the barrel of the gun, every bullet is made to revolve about its center of shape or form, about the center you would find by calipering it for the purpose. If, however, the jacket is thicker on one side than the other, or if there are air bubbles in the lead, or wrinkles such as we see on some cast bullets, or other defects, the heavier side pulls the bullet outward from its true course as soon as it leaves the gun. Since the bullet is revolving, this pull is changing from downward to left side, then upward, then to right side, and so on, as the bullet flies forward. Its course through the air is a spiral line. It corkscrews forward. It might strike at nine o'clock on a target at 50 yards and at three o'clock at 100 yards. A bullet in which the center of weight or axis of weight coincides exactly with the center of form will not do this.

In the example of the 25-20 rifle previously mentioned, the 87-grain bullets were distinctly smoother and truer in base than the 86-grain ones, as could be seen with a microscope. It is probable that they gained that extra eighth of an inch in group by reason of more nearly true bases. In the example of the 45-120-550 rifle, the three off-shots failed to find the normal group probably by reason of both these errors. To make them fly correctly, they would have to be made more carefully, and not only made, but loaded without marking or mutillating them, and delivered fromthe muzzle of the gun in perfect condition.

To gain one inch in smallness of group at 600 yards or two inches at 1000 yards the most exacting refinements are required along the lines indicated above, as well as in other details to be mentioned. A match may be thrown one way or another by half an inch, which might be the result of a single dent on a single bullet. To show what careful selection of materials is required for super-accurate amunition, and what rigid inspection is needed in their loading, the following may be quoted from a description of the preparation of some special match amunition at one of the factories.

"The bullets were spun for eccentricity, weighed for variation, the jackets and the cores being weighed separately, and then were assembled in master dies under very heavy pressure to insure uniformity in density of metal and true lines of form. The cartridge cases were also spun for trueness so that by no chance would the axis of the necks be out

of line with the axis of the bodies of the cases. A line passing through the point of the bullet in the finished cartridge would pass through the exact center of the cartridge case and primer. The powder of course was weighed by hand, the charges being kept within a tenth of a grain variation."

In previous chapters a great many fundamentals have been outlined which of course must be looked after by the handloader seeking superior accuracy. Bullets must not vary in weight, for instance, not only on account of the varying ranging power of heavier and lighter bullets, but on account of the effect on the burning of the powder charges of their inertia. They must be held uniformly in case necks to develop powder gases uniformly. They must be seated to print into, touch or almost touch the rear of the rifling lands, in order to start the bullet as truly in line as possible. They must be of correct diameter.

The 45-120-550 rifle previously mentioned at first made three-foot groups at 100 yards with bullets of the supposed-standard .457-inch diameter. Its fine accuracy was obtained later, after its groove diameter was discovered to be .465-inch, and bullets made accordingly. The 40-70-330 rifle would do nothing with standard .403-inch diameter bullets, but responded as noted to bullets which allowed for the real groove diameter of the barrel, found to be .410-inch. These obsolete cartridges and rifles present more difficulties than handloaders usually will experience with modern rifles and present-day components for them, yet just such things in greater or less degree are what we must detect and correct. Only a test can show what will give finest results in your particular rifle.

The making of bullet molds is a very exact process. Suppose, of instance, the original hole is not drilled precisely perpendicular. The cherry will follow the outline of the hole—and you get a bullet mold which casts oblique bases. The remedy for such a tool is a new and better one. Sizing and swaging of solid bullets should always be done base first, to prevent burring the edges of their bases, and should always be perfectly straight-line, to avoid pressing their bases out of true with the long axis, as well as to avoid reducing one side more than the other. For target and serious hunting purposes jacketed bullets of the best obtainable quality are desirable. Since this is a faulty world, the best will not be quite perfect.

Cast bullets should have no metal shavings left in their grooves by the sizing and lubricating machine. Size them dry, then wipe them clean and lubricate them afterward, for specially fine shooting.

It is worthy of note that in speeding up the 30-30 by lightening its bullet from 170 to 110 grains, the Remington Company apparently has increased the diameter from .306-inch to .309-inch or slightly larger—for a .308-inch barrel. In doing so, the accuracy was bettered by more than an inch at 200 yards. Why a sub-caliber bullet was used in the first place no one now probably can give a good reason, but it was used in this and a number of other earlier smokeless cartridges. Other 30-caliber cartridges, and the 25-calibers, use groove-diameter bullets and give sperior accuracy. The lesson for handloaders in the 30-30 development is that with the lighter bullet it became necessary to obtain more resistance than mere weight provided, hence the bullet was made slightly oversize, in order to cause the powder to burn fully. Incidentally the powder burned more uniformly, giving the increased accuracy.

The powder subject has been outlined in previous articles.Fine accuracy can not be expected from any powder used below its pressure-class. It will not burn fully or uniformly. It burns most uniformly from charge to charge when in confinement that brings the pressure just about to its maximum limit. Witness the accuracy obtained in 30-1906 full charges giving 45,000 pounds or thereabouts with HiVel powder, also the splendid accuracy given by *reduced* charges in most rifles when low-pressure powder is burned at about its top limit. Nitroglycerin powders normally give only four or five feet variation in velocities when other components are high grade, while "progressive-burning" or coated nitrocelulose powders usually give at least ten or fifteen feet. The former powders ignite readily, the latter slowly. The difference at the target is enough to win close matches, but is a mighty small item compared to errors of flight due to defective bullets and cases, or careless loading.

The ignition of the powder charge is as important as any other item in the obtaining of fine accuracy. In fact, it is in ignition and in more perfect bullets that future improvement of accuracy lies.

A positive hang-fire or misfire is the last stage of ignition trouble. Primers are designed to be struck a certain blow by the firing pin at an exact center spot on their faces, and when kept free from excessive moisture are presumed to drive a flame of a certain length through the flash hole of the cartridge case, which is of a certain size. A good many ifs are embodied in the foregoing. The powder requires the full temperature and length of flame to fire it promptly and thoroughly. With less firing, its combustion is erratic and accuracy suffers.

Modern smokeless primers when fresh will do the work they are intended for with a reliability and regularity that is really astonishing. Nevertheless, it is worth noting that twenty years ago shooters had trouble igniting Schuetzen and duPont No. 1 Smokeless and other brands uniformly enough to give fine accuracy. They resorted to the use of a priming charge of two, three or more grains of black powder, which produced excellent results even with the primers then available. Those bulk powders were easier ignited by far than our present No. 15, No. 300, No. 308 and No. 18. Off-shots are quite frequently due to subnormal ignition alone. Shots which strike in the "normal" group always have been fired with a "standard" flame from the primer. Fine accuracy is practicable with any powder, but is easier obtained with some powders than with others because small faults of ignition of their charges are not so certainly translated into variations in pressure.

You have seen the blue or purple shellac on Government amunition, about the primers and possibly about the bullets. That is to keep moisture from the air out of the primers and powder. Primers kept in damp atmosphere will be weakened. Certain chemicals used in certain lots of war-time primers proved to be defective by reason of their more than usual absorption of moisture and from other causes, and these, together with a few other primers handloaders possibly may get, will not provide the flame and heat necessary to fire powder with accuracy in shooting.

I have seen Springfield 1906 rifles with mainsprings weakened which would not shoot some lots of amunition accurately, although other amunition was accurate in them. The reason was that the firing pin blow was not sharp enough to fire the first lot of primers *uniformly* Most shots were off-shots. When those cartridges were tried in Springfield rifles with stiffer mainsprings, it shot very well, most of the bullets going into the normal group. Hunting rifles of the cheaper grades, particularly those of foriegn make, sometimes have firing pins decentered enough to strike primers a little to one side. They seldom shoot well, because the ignition is irregular. Primers should be struck squarely on their anvils.

A handloader should watch for cartridge cases with primer pockets not drilled truly at the centers of their heads. He should throw out, all cases with pockets too deep or too shallow, because in them primers will be held at varying distances from the firing pin and may give varying flames as a result. Flash holes must be kept perfectly free from dirt. If they are too small, they may be enlarged with benefit, but must be kept uniform. Cases with heads or shoulders which permit them to chamber deeper than normal will cause the firing pin to strike the primer with varying effect, hence should not be used when fine accuracy is desired.

In theory, at least, the case that shoots with greatest accuracy in any gun will be the case fully expanded in it by firing. It should line up most precisely with the bore. It should be better than a new case.

We see in descriptions of certain powders the command: "For use with jacketed bullets only." The reason for this requirement is not entirely that solid bullets will not shoot without stripping at the velocities for which the powder is intended. The hard jacketed bullets offer more resistance than solid bullets can be made to give, and this resistance is absolutely necessary to burn the qowder with accuracy.

One of the reasons that jacketed bullets give finer accuracy than solid ones is that they are less damaged in the loading of the cartridges and in the firing within the gun. The loading tools and the case neck must be just right to permit a relatively soft cast bullet to be seated without disturbing its sensative true outline and weight balance, and to keep it aligned true with the bore of the gun.

Handloaders must bear in mind that it is necessary to deliver bullets in perfect form from the muzzle, as well as to load and cham-

ber them correctly. It takes extreme care in the casting, the sizing, the lubricating, the seating in cases, to get fine accuracy from cast bullets.

Excessive pressure in the gun may warp or swage any bullets out of shape, particularly if they are over or under throat diameter very much. A bullet which upsets under pressure is not likely to take a new diameter or form by swaging or swelling true all round. One side will go easier and sooner than the other. The 1923 Government test-winning amunition is a conservative load. Its 170-grain bullet is driven at only 2650 feet velocity, by less than 42,000 pounds pressure. Doubtless greater pressure under the conditions of this load and rifle would deform the bullets slightly, causing decrease in accuracy.

Fitting your amunition to your individual gun means many things. We have mentioned some of them. Another is to avoid overloading your gun, considering its weight and its rigidity of barrel and action. Maximum accuracy with the old 45-70 Springfield army rifle was obtained only with a rifle of 16 pounds weight. The Government cut the powder charge from 70 to 55 grains and the bullet from 500 to 405 grains for its 45-70 carbine. Major Whelen warns us to avoid turning down the 30-1906 Springfield barrel. A slimmer barrel than standard will not handle normal full loads intended for the standard barrel because of excesive and different vibrations. To put the matter the other way round, you can use heavy loads in a heavy barrel and gun, but for a light gun with a slim barrel, better scale down the charges—in fact, you must scale down the charges to obtain accuracy.

Chapter Nine explained the measuring and weighing of powders. Sift your powder well before using it, to remove dust which will alter its rate of burning and pressure. All the finer powders can be measured with accuracy to within a fifth of a grain in a Bond or Ideal measure if due care is taken. When you first put powder in the measure, tap it down a few times. If you do not, the first dozen charges will be off-weight. Do this before adjusting the measure.

Twist of rifling must be considered by handloaders in search of maximum accuracy. If a certain bullet tips in a slow twist, drive it a little faster to stiffen it in its line of flight, by increasing its rate of spin. Very heavy and long bullets may have to be kept well down in velocity to avoid excessive spin and to avoid distorting them in the barrel when they are fired.

The use of non-fouling bullets, hard and tough enough if cast, modern enough if jacketed, is of great importance in loading amunition for superior accuracy. The barrel that is metal fouled in the middle of a string will deliver no high score, no matter how well the first shots strike.

Worn rifles often can be improved in accuracy by fitting them with bullets and powder charges suited to their enlarged dimensions.

The "mean radius system" of measuring a group does not indicate the off-shots as diameter of group does. The "M. R." corresponded to average string measurement per shot *from the center of impact or the group*. It gives greatest value to the shots in the *normal* group. The mean radius figure of a group is quite often about one-third the diameter of the group. Thus in the 1923 Quantico test, the winning amunition gave a mean radius of 5.392 inches against a thousand-yard group size of 19.3 inches by 14.1 inches.

A five-shot group is never conclusive. If any of the components are defective, a ten-shot group will develop off-shots that cannot be identified among the five shots. Recently an Arms Company published a striking advertisement showing six five-shot groups of five shots fired at 100 yards. Each one was smaller than eight-tenths of an inch. A composite of the six groups on one paper—the thirty shots as they struck—made a group 1.9 inches across. That is good shooting, indeed, yet it enlarged the five-shot group by more than 100 per cent.

The "normal" group should be the handloader's guide and inspiration. The six, seven eight or nine close-in holes among each ten shots fired show what can be depended upon when the usual faults and defects of amunition are eliminated. A handloader wanting specially accurate amunition for match shooting, for instance, can select bullets with a reputation for correct design, exactness in dimensions and weight, and non-fouling jackets. He can employ cases and primers, and tools, that conform to the needs of his particular rifle. And when such components are assembled with care and judgment they should give groups well within two and a half inches diameter at 100 yards, and when the eye and gun are likewise better than average, should group into one and a half inches, or even one inch, at that distance. Of factory amunition, only the special match product can be depended on to do as well.

A Tale of Two Rifles

Continued from page 5

chance and slightly oiled the cases after that to complete the tests of the rifle, which is not a procedure I want to recommend to anybody else, and fired about forty shots without harm although the lever would spring in my fingers with each shot. With the tests finished I ceased oiling the cases, and in five shots had a broken shell in the chamber, the bolt extracting the rearward portion. I shipped the rifle to the factory in this condition, having in mind various instances where their tests had shown me entirely wrong, as is the wont of gun and ammunition factories.

The signs of head-space consist chiefly in the ring which appears running around the case a half-inch or so forward of the head. It is an incipient separation. It may not appear at all in a brittle case, because the separation is completed, it is most likely to appear with soft cases in a head-spaced rifle.

In a hunting rifle such a separation might ruin a trip without a broken shell extractor. It is sometimes possible to drive an empty case into the broken off forward portion, and then drive out the twin by dint of a cleaning rod—if one is along, which is often not the case. Given a fair chance brass will lock more firmly to brass than the brass will to the steel of the chamber, but this in turn depends on how soft the case was originally, and how much it freed itself from the chamber walls by its natural spring and resumption of its original form.

Sometimes a bullet driven down from the muzzle will pick up the neck of the case and permit driving it out, but as you know, working a service bullet down the bore of a rifle is not the job for a Marble folding cleaning rod, which is likely to be the sort you have along—if any at all.

I have seen several million rounds of ammunition fired under such conditions at Camp Perry where I was experimental officer and general "trouble shooter," and the Small Arms Ballistic Station in Florida, as to permit me to know when trouble occurred, and I do not think I have seen ten separated cases in rifles in all this time. Wherefore the likelihood of a broken case in a hunting rifle is practically nil provided the shooter has used it enough before leaving to make sure that it is developing no bright annular rings at the rear of the case.

Wherefore, returning to our wrecked Navy rifles, we have as our clues a, brittle cases; b, old and likely brittle receivers; c, undoubtedly excess head-spaced rifles; d, probably oily chambers, because even if the rifle were wiped out, it is difficult to remove such grease or oil without gasoline, as would serve to lubricate the case a trifle.

I saw a frightfully wrecked rifle shipped to the Ordnance Department by some gentleman in Arizona in 1920, which duplicated the conditions of the Navy wrecks in the matter of old and likely brittle receiver. I believe this shooter was using hand-loaded ammunition, but see no reason for laying the wreck at his door for any such reason, it showed no more signs of high pressures than did the Navy guns.

It should be kept in mind that high pressures are not necessary thoroughly to wreck a service rifle. The normal pressure is quite high enough if it is permitted to escape through a bad case, head-space or other reason. Once the gas at its 50,000 lbs. gets out of the back of the case, it proceeds usually to lift off the top of the receiver ring or threaded hood, which was done in this instance, and then having got-

ten this much of a start, to flow down into the magazine, bulge it outward, split off the wood of the stock, and if the receiver is brittle enough, generally wreck the rear end of the rifle.

With later date receivers made since the 800,000 mark there is sufficient margin of strength to hold the receiver together, and the back end leak usually results in merely blowing off the extractor, slightly fusing the head and lugs of the bolt, and often bulging the magazine walls and splitting the stock.

Usually such accidents as those of the Navy result in a stampede to get rid of the rifles of earlier date than the double heat-treated receivers, but there is little reason in this. The newer East River bridge is undoubtedly stronger than the old Brooklyn bridge but have you noticed them throwing the old timer into the drink because the new one has more safety margin?

Either has sufficient unless you go to tightening up the cables on one side of the old timer, and slacking off on those of the other side and producing some form of "bridge-space," which is contrary to the designs of the engineers. The service rifle was not designed to hold a case acting within like the piston in gas engine, nor yet rupturing where it is supposed to be holding the gas to its work.

I own a rifle made in 1911, which I purposely bought from Springfield after the war, because of the excellence of fabrication, and I don't propose to swap this for a yaller dog and shoot the dog because of any dates or serial numbers. All of them were given a proof charge, and possess adequate factor of safety if not abused. These rifles were probably fired five million rounds for each shot which made any trouble because of any lack of safety margin, which is a fair scale of odds.

However the condition of the ancient receivers and bolt is one not depending on date of fabrication or serial number, but on use. Any steel will gradually crystallize if constantly hammered, particularly if already glass-hard part way through.

If you are using an ancient receiver and bolt, whether or not you have swapped around for other than the original bolt and are also using war ammunition with the idiosyncracies of that hurriedly-made stuff, it would not be a bad idea to have a new bolt fitted lest the other have accumulated head-space through long hammering and wear, or else retire the veteran in favor of a new one. The matter is one of long use, not age or serial number.

And, if you have traded around and got some bolt in your rifle which did not originally come in that rifle, and it has not been gauged to see that everything is all right, I should suggest a careful inspection of the photographs I am using with this article, because this little matter of bolt-trading, coupled with ancient and long-used receivers, is what I suspect lay back of the two worst-wrecked rifles I have ever seen.

Blown up rifles have been noted before this, but two so enthusiastically blown up rifles happening in about one week in a squad of thirty or forty men with ammunition developing less than 50,000 lb. pressure offers plenty of incentive to stop and check up our own equipment to make sure that we won't some day go and do likewise.

The Ballistic Primer

Continued from page 7

except in the matter of rust.

Considering possible substitutes, it may be of interest to look into the chemical composition of a few in comparison with the chlorate of potassium. The following table, from Marshall's book on "Explosives", previously referred to, shows:

Oxygen carrier	Density	Reaction	Heat evolved per 100 grams	Oxygen available per 100 grams
Nitrates				
Potassium	2.08	$2KNO_3 = K_2O + N_2 + 5\,O$	−74.8	39.5
Sodium	2.26	$2NaNO_3 = Na_2O + N_2 + 5\,O$	−71.3	47
Calcium	2.36	$Ca(NO_3)_2 = CaO + N_2 + 5\,O$	−43.0	49
Barium	3.2	$Ba(NO_3)_2 = BaO + N_2 + 5\,O$	−36.1	31
Lead	4.58	$Pb(NO_3)_2 = PbO + N_2 + 5\,O$	−16.5	24
Ammonium	1.71	$NH_4NO_3 = 2H_2O + N_2 + O$	+34.5	20
Chlorates				
Potassium	2.00	$KClO_3 = KCl + 3\,O$	+ 9.7	39
Sodium	2.29	$NaClO_3 = NaCl + 3\,O$	+12.3	45
Barium	3.18	$Ba(ClO_3) = BaCl_2 + 6\,O$	+ 8.5	31.5
Perchlorates				
Potassium	2.54	$KClO_4 = KCl + 4O$	− 5.6	46
Sodium		Etc.	−10.2	52
Barium			− 1.3	38
Ammonium	1.89		+25.1	34

From this table it is evident that insofar as the proportion of available oxygen is concerned, the chlorates carry about the same quantity of oxygen as the corresponding nitrates, but these latter require heat to decompose them, that is, they *take it up* on decomposition, while the chlorates, on the other hand, *give out* a small amount of heat on decomposition. Regarding sodium and calcium, the chlorates decompose into salts somewhat similar to potassium chloride, and there is little chance of remedy with them. Lead nitrate has available oxygen in the order of 24 as compared with 39 for potassium chlorate, but as noted above, it takes up heat in decomposition. However, the heat required per 100 grams is 16.5 as compared with 36.1 for barium, while there is only a difference of 7 in the order of available oxygen per 100 grams. It is possible that lead nitrate may be found to offer a suitable substitute for the chlorate. Some experiments have been made along this line but so far the results have not been conclusive.

This discussion was introduced with a view to showing just how complicated the ammunition problem really is, even in what might appear to be its most simple aspect.

To continue the consideration of the design, the next step will be as to the material for the cartridge case.

Brass, ordinary, common brass, is well might, in many cases do no harm, would undoubtedly result in a spoiled brass for cartridge cases.

Attempts have been made to use aluminum alloys for cases, and a recent sample looks quite good. It is in 7.9 m/m size and is made of Duralumin, a patented alloy. There is quite a saving in weight, nearly one-third, and quite possibly the basic is cheaper, weight for weight, than brass. On the other hand, the cases are weak at the neck, and the bullet can be bent out by a good stiff wrench with the fingers. These cases are crimped, and so do not require to be very elastic to hold the bullet in place.

This brings out the question as to whether to crimp the case which is being designed. The answer is "Don't crimp." With good brass and sufficient bearing of the bullet to give a proper adhesion there is no necessity for crimping, particularly as the cartridge will probably be used (how nice it would be to have this kind of a dream come true) in a box magazine rifle. Such crimping as we see now is mostly a relic of days gone by when the art of making brass was not so well understood and when, in tubular magazines, the loosely held bullet was likely to be pushed

known to be an alloy of copper and zinc, yet when it comes to the selection of a brass suitable for cartridge cases it will be found that great care must be exercised in making up the proper proportions, else the metal will not "work" properly nor will it last well in storage. Undoubtedly every one has seen a cartridge with a "split neck"; but that these are so few is the wonder, rather than that they occur at all. When the bullet is put into the case there is usually a slight stretching at the neck and the metal is therefore under tension. The brass must be sufficiently hard and resilient to function properly when the charge of powder is fired, but is must be soft enough also so that it will not be brittle and crack.

The proportions of copper and zinc are usually two-thirds to one-third in the brass used for cartridge cases, but these w[illegible] with the quality of the metals themselves and with the manner in which the alloy is made. Particular care must be exercised in selecting the zinc for this use, as some impurities which

back into the neck of the case.

Of course, the matter of split necks also comes in here, but who wants to keep ammunition forever, anyhow. A crimped case means very probably a cannelured bullet, and the cannelure is strongly suspected of being responsible for ringed barrels, in this manner. The bullet strips a little and the rear portion of the jacket breaks off and sticks in the bore. Next shot, ringed barrel, very probably, and a much disgruntled rifleman.

Looking back over what has been done, the cartridge case for this study will be of brass, of cubic capacity .167 cubic inches or about 42 grains of water and will contain a charge of 38.5 grains of IMR 15½ or a similar powder. The estimated pressure will be 50,000 pounds per square inch and the rifle should be designed to withstand a proof charge giving a chamber pressure of from 68,000 to 70,000 pounds per square inch. The case will be 1".97 long, of the semi-rim type, uncrimped, and will have a neck of sufficient length to provide for proper holding of the bullet. Such a case would quite probably work very well in any of our modern type rifles, and the study has shown, in a way, some of the things with which the ammunition designer has to contend.

Conducted by COL. C. E. STODTER

THE Office of the Director of Civilian Marksmanship was established by the Act of August 29, 1916. The establishment of this office was for the purpose of promoting rifle practice among civilians and to give civilian riflemen a means of securing through the War Department, either by free issue or by purchase, the necessary arms, ammunition, and other supplies to enable them to engage in rifle practice.

The Office of Director of Civilian Marksmanship has charge of all issues made to regularly organized government civilian rifle clubs, keeps the property accounts of these clubs, and is accountable to the War Department for the property issued. This office also makes all sales of government arms, ammunition and other supplies for the promotion of rifle practice among civilians, and arranges with the Ordnance Department for the manufacture of supplies, and for the sale of surplus and obsolete material at reduced prices.

This office also makes arrangements for the use of Government ranges by civilian rifle clubs, where such ranges are available in the vicinity of the club, and handles all firing for qualification by civilians, keeping the records of such qualifications and issuing the appropriate badges.

In addition to above activities, there is a large correspondence with rifle clubs and individual riflemen on practically all subjects connected with rifle and pistol shooting. It is the purpose of the Director of Civilian Marksmanship to publish in THE AMERICAN RIFLEMAN, from time to time, notices of changes in regulations, information regarding new material which may be available for free issue or purchase, information connected with rifle shooting, ammunition, handling of property and various other subjects of interest to riflemen throughout the country. It is desirable, therefore, that rifle clubs and other individual members of the N. R. A. should subscribe for THE AMERICAN RIFLEMAN.

FREQUENT requests are received by this office for star-gauged, .22-caliber rifles. The process of star gauging has not been applied to the .22-caliber rifle owing to the difficulty in making an accurate star gauge for such a small caliber; consequently, we have no star-gauged, .22-caliber rifles. These rifles, however, have been made with the same care and precision as is used in making the .30-caliber rifles. The obsolete rifles, which are being sold at reduced prices are not star gauged. The process of star gauging means more than merely measuring the bore of the rifle. When rifles are manufactured at an arsenal they are star gauged and those that conform to the specifications required for star-gauged rifles are issued or sold as such. It will be impracticable, however, to take rifles which have been packed for storage, clean the grease out of the bores and select those that conform to the star-gauged specifications, as this might require the measuring of a large number of rifles in order to obtain one that would conform to the requirements. This does not necessarily mean that rifles that are not star gauged are not accurate. Many of them are equally as accurate as the star-gauged rifles.

How About This?

Dear Sir:

Funds are now in our treasury to send at least four shooters to Camp Perry, and several more expect to make the trip from here.

We want outdoor matches, .22 or .30 caliber.

Have written every club that I have the address. If you know of any clubs looking for post matches please let us know.

Respectfully,

LAWRENCE PARK RIFLE CLUB.
(Sgd.) C. T. PATTERSON,
Secretary.

843 Napier Avenue.

THE attention of all rifle clubs and individual riflemen is called to the series of articles on Individual Instruction in Rifle Practice by Col. A. J. Macnab, United States Army, which started in ARMS *and* THE MAN for May 1.

This system of instruction has been thoroughly tried out in the Regular Army for several years and has produced excellent results. This system can be used by rifle clubs or by individuals. Two or more shooters can coach each other and get good results if no experienced instructor is available. There is nothing in this system that cannot be readily understood and easily applied by civilian riflemen.

In rifle shooting as in other forms of sport there are certain fundamentals that must be thoroughly learned and carefully practiced before excellence can be acquired. No one can become a good shot unless he knows how to take the correct positions, how to adjust his sight, how to aim correctly and uniformly and how to squeeze the trigger correctly.

There is no sport that requires greater care and concentration than rifle shooting, No man was ever born a good shot, but every man whose physical and mental conditions are good can become a good shot by carefully following the system of instruction given in Colonel Macnab's book.

Many civilian riflemen are unwilling to take the time and trouble to learn and practice the fundamentals of rifle shooting. They want to start shooting at once and usually with a high-power rifle at long range. I have seen new members of rifle clubs start shooting without any instruction in the positions, use of the sling, adjustment of sight and trigger squeeze. They become discouraged with the poor results obtained and give up the sport thinking they cannot learn to shoot. The new man should not be given a rifle and ammunition and be allowed to shoot on the range until he has been given a thorough course of instruction.

Rifle clubs located near Government ranges should take advantage of the opportunity offered by Special Regulations No. 107, which authorizes civilian rifle clubs, schools and colleges to fire on these ranges by first making application to the Director of Civilian Marksmanship. The Commanding Officer is authorized to detail instructors and to loan rifles and issue ammunition and target material to civilian organizations, and to conduct record practice for qualification. All rifle clubs should try to qualify all of their members by firing one of the Regular Army courses during the present season.

Correcting the Shooter's Vision

Continued from page 9

focal lenses where two different prescriptions are ground in the same glass. It appeared that the only practical solution was to superimpose upon a normally centered lens a small prism in exactly the right position and having exactly the right axis or angle of vision, and this involved a problem of considerable delicacy and precision.

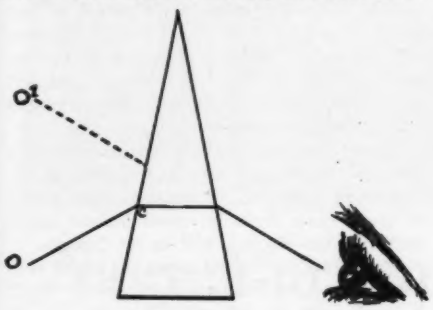


Fig 1

The optical effect of a prism. O appears in the position of O¹.

His interest in the matter was so great, however, that he asked me to let him experiment, which I willingly agreed to. The result which he achieved was a pair of shooting spectacles that I can wear all day and every day and yet which are instantly the exact thing needed when I snap my rifle to my shoulder and my head into position for sighting. The accompanying illustrations will clearly show how the problem was solved, and my chief purpose in telling this story is to give encouragement to those other oldsters who, like myself, are unwilling yet to be laid on the shelf and labeled as "has beens."

MR. F. C. BALDWIN has asked me to show with a few sketches and a brief explanation how his shooting glasses were made.

To some—the production of spectacles must seem to be about the coldest thing possible. A prosaic, matter-of-fact computation of formula and mechanical process.

However, when Mr. Baldwin had told me of his needs and desires the romance of the formula became manifest, for his story carried mental pictures of landscapes and seascapes. It carried the thought of dangers to be braved, and adventures passed. It sang the lure of travel, the excitement of sport, the call of good fellowship. And, so we went to work

First of all, Mr. Baldwin's glasses disturbed him while shooting, but *only when he was shooting.* And the reason was this: Mr. Baldwin wears a strong myopic correction. When he looks through any part of his lens other than the optical center, a great prismatic deviation takes place. The greatest amount of this error is at the periphery, or edge of his lens. It is very near this point that he looks through when shooting.

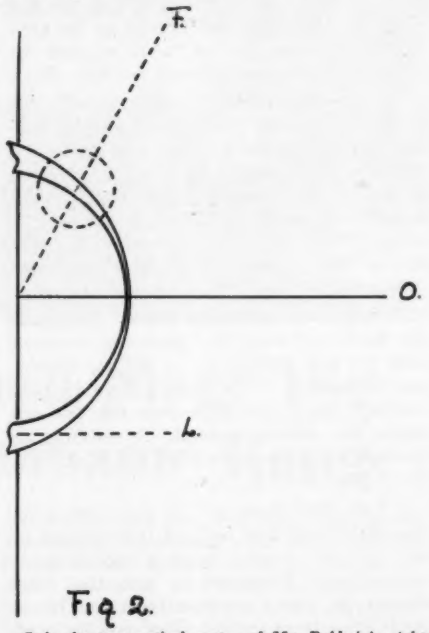


Fig 2.

O is the true optical center of Mr. Baldwin's right lens. F is the field used while sighting. Bounded by the dotted circle which represents the diameter of the field, is shown the base and apex of prism that is the disturbing factor in the uncorrected lens.

In Figure 1 is shown the optical effect of a prism. Rays of light from O strike the prism at C, undergo refraction and falling upon the retina of the eye are projected outward in the direction from which they came to the eye, and the position of O is apparently changed to O¹.

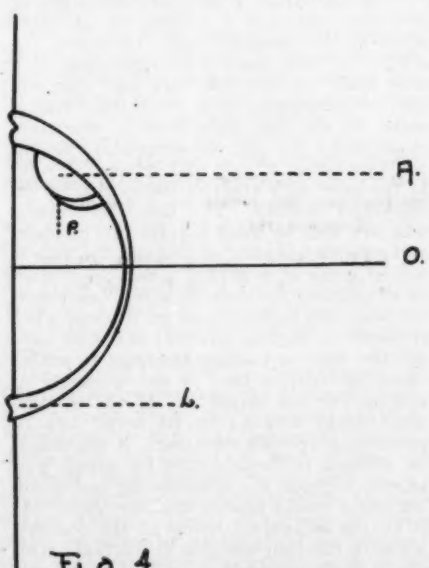


Fig 4.

O is the true optical center; A is the auxillary optical center of lens created by the corrective prism P. L is the lens.

That section of the lens bounded by the dotted circle in Figure 2 clearly shows the base and apex of prism in Mr. Baldwin's right lens.

The first step was to locate the exact area of the visual field used by Mr. Baldwin when in firing position. The optical center of the lens was marked, and the lens then bisected with cross lines in the vertical and horizontal meridians, namely 12 o'clock and a quarter past 9. This gave us our zero mark to work from.

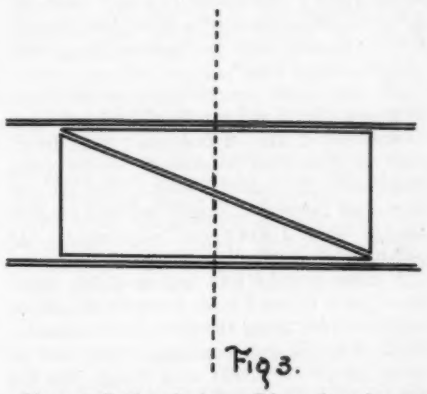


Fig 3.

The neutralization of prisms. Prisms of equal power, placed base to apex as above, neutralize each other.

Then—with rifle in position, and Mr. Baldwin aiming—a vertical line was drawn through the pupil area, and coinciding with the rear sight. The same thing was done with the horizontal meridian in this area.

Finer and finer markings were made until we were assured of absolute accuracy. Then the diameter of this field was plotted. Figures 2 and 4 show this field.

Having these measurements, it then was necessary to compute the prism value of the lens in this exact field and angle used by Mr. Baldwin in shooting. After this data was obtained, the corrective prism in the shape of a circle, the exact diameter of his shooting field, was cemented on this predetermined area with a special cement. Figure 3 shows the neutralization of prisms. Two prisms of equal power placed base to apex neutralize each other.

In Figure 4 is shown the corrective prism in position. When Mr. Baldwin raises his rifle to his shoulder and aims, he receives just as perfect definition through this auxiliary optical center as he does through the true optical center of his lens!

The slightest deviation of this little prism would destroy the value of the glass—turn a hit into a miss—perhaps victory to defeat.

One thing more. I realize how very crude these sketches of mine are and my apology is the fact that I am an optician and not a draftsman.

WOODCHUCKS

By FRANK RIDGEWAY

MY FIRST recollection of killing a woodchuck dates back a long time, but how well I remember it. Then sometimes, when I read an article on the ideal chuck rifle, I commence to count over the different arms I have used in the last twenty-five years, and come to the conclusion there "haint no such gun."

My first chuck was killed by an old shepherd dog after I had run Mr. Chuck out from under one of the old-fashioned "ash drys," used at that time to extract the lye from wood ashes for making soap. The old dog accounted for several chucks before I reached the age where I was permitted to use the old patch-and-ball rifle that hung over the door.

I think the old rifle was used for about three years before I made the raise of a Remington No. 4, using the 32 rim-fire ammunition. The old patch-and-ball killed just as clean as the 250-3000 does today, but the ranges were short and I used the head only as my target. Tried the 32 R. F. long cartridges in the Remington but they were not so accurate as the shorts, so used the shorts.

I would be afraid to even guess at the number of chucks this rifle accounted for, but they ran way up in the hundreds, as they were plentiful and I used the rifle for years.

Next came a Winchester 73, using the 44 W. C. F. cartridge, also a set of Winchester tools and mold. Talk about the ideal rifle, I now had it, and the way the chucks rolled over in front of it was a shame. No cripples, clean kills and not all head shots either, but all at short ranges. I still have the loading tools for this same rifle, but the rifle itself was given to a guide in northern Minnesota when I returned from my first and only trip after big game. Too much work and too few shots for me. Chucks suit me better.

While the 44 W. C. F. was still in service I came into possession of a 45-70 Springfield and about 500 rounds of ammunition of the old tin-case kind. Yes, the 45-70 killed them and lots of them, too, as this ammunition cost me but little, so I took all kinds of shots and even killed them at some exceedingly long ranges for this cartridge.

Then down along the line came the Krag, 32-20, 25-20, 25-35, 40-70 S. S., 25 R. F., 250-3000, 30-06, and, I suppose, others I haven't named. Yes, in this time I used the 22 R. F. in both the short and long rifle. The Winchester 1890, using the 22 short only, has accounted for many a chuck, not only the one I had, but it was rather a popular rifle around here and was used just the same for a chuck as a sparrow and killed them, too, but had to be a well-placed shot, of course.

Not so many years ago I was chuck hunting with a couple of friends. One had a 250 Savage, the other a 256 Newton, so I picked up the Winchester 22 short when we started, with the remark I would dispatch the cripples.

The only cripple was one I had to take the second shot at as he made a run for his den. My first one took him a little too far back, but the second one landed in the neck and he stopped. I think the 22 counted for six this day against one each for the others.

My favorite rifle has always been the 25-20, but the trajectory was always a little high for long shots with the factory ammunition. However, I succeeded in working up a hand load that gave ideal results. The new Remington 25-20 Hi-speed in their slide action Model 25, should be the ideal for chuck. Haven't tried it, but have one on the way and will use it this coming season.

Now, you can take your choice. I suppose the Airdale of today is a great improvement over the old Shepherd for killing chucks, also the new H. V. loads over the old patch-and-ball, but if you know your rifle and can shoot, the caliber amounts to nothing, as the smallest made is the .223, and it will kill, for I have tried it.

I have had them get in their den after the 250 Savage had reduced their weight by half, the only trouble being it had taken the wrong half. I believe, in fact, that more chucks get away cripples from the H. V. loads than from the old black powder loads for the single reason they are shot at at unreasonable ranges. Sure I know I have done it. Had a 250 Savage with a scope on it and all I wanted was Mr. Chuck's address and I would shoot if there was a bank behind him so the bullet would do no damage. It is true I have killed them at ranges longer than would have been possible with slower ammunition, but the kills were few.

At over 150 yards the misses begin to outnumber the hits. I don't care what kind of an arm you use, sights you have or who you are, and at under 150 yards there are several fine cartridges that will do the work.

Oh, yes; I know you will say you can get him at 200 yards every shot. Well, if you have a good rest and lay and wait for him this is possible, but if you take them as they come, strictly off hand, I will cut that 150 yards down to 100 yards and still the misses will outnumber the hits.

On account of the thickly settled country a light bullet, 60 grains or under at a M. V. of around 2,500 f. s., is about all that is safe to use. These light Hi-speed bullets unless shot over the skyline, will do no damage.

The .22 caliber barrel using the 32-20 shell necked down, and the one using the 22 W. C. F. shell with the 49 gr. bullet and No. 50 powder comes very near the ideal if your pocketbook will stand the strain.

Now, go ahead; I haven't chosen any in particular, and you wouldn't agree with me if I had because I know you are a crank, and they just can't agree, but be careful and don't kill any at over 500 yards.

When I try for a long shot I generally use the sitting position. Will grant you the same privilege, all others must be off hand. With all due respect to H. M. Pope, "Stand on your hind feet and shoot like a man."

A Safety Reloading Kink

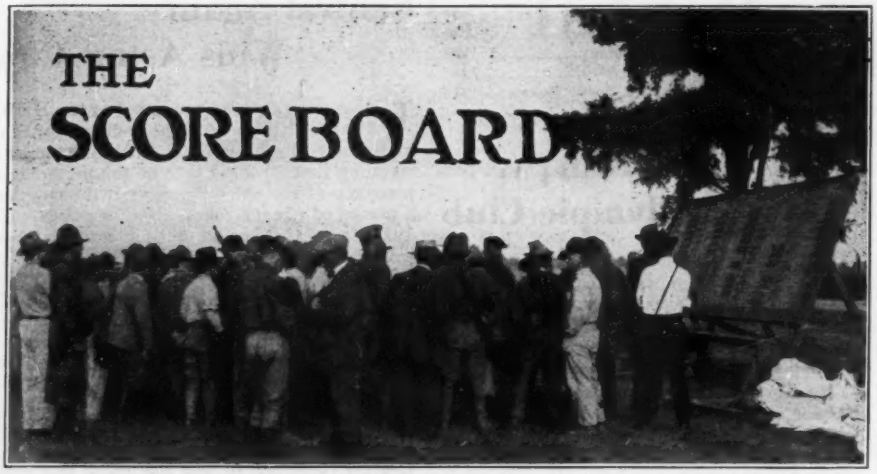
By L. J. HATHAWAY

OUR Government is doing a great deal to encourage a general knowledge of rifle shooting, and I believe we all have much to be thankful for. Certainly the ability to load one's own cartridges is a true asset to any rifleman, and deserves the encouragement it is receiving. But it seems to me that right here is one more opportunity for the Government to render the homeloader a very real service. I refer to the very high transportation charges on smokeless powder. For those individuals who are able to band together in numbers and order a quantity of powder, the rate is not so much of a burden. But there must be throughout the country many lone shooters who, like myself, must go it alone when it comes to buying powder; and who have not the cash or storage facilities to enable them to order a year or two's supply of powder for one shipment. If the Government could arrange to let small lots of powder, in special containers, if necessary, be shipped to homeloaders by parcel post or even express, the homeloading and shooting game would receive another boost. As it is, the individual living in the country, while in the best position for actual shooting, is in the poorest position when it comes to obtaining the powder with which to shoot.

Here is a little safety kink on reloading which you may publish or not, just as you see fit:

As just one more safeguard against the possibility of getting a double charge of powder into any cartridge case when reloading, the writer has devised the following plan.

Use two loading blocks. Have one block of the regular type, to receive the cases after they are charged with powder. But make the holes in the other block large enough to receive the body of a case up to about the middle of its length, but not large enough to admit the head. Then, the only way cases can be put into this block is open end down. Use a thick piece of wood for this block, and make the holes deep enough to allow some space below the open end of the cartridge case. In loading, place the large-hole block at the right of the powder measure, and the small-hole block at the left. Fill the latter block with empty cases, and do not charge with powder any cases other than those taken from this block. Should a case already containing powder get into the small-hole block, the powder will be promptly dumped into the bottom of the hole, and the case will come out empty.



Navy Marksmen Stage Big Shoot on Guantanamo Range

DURING the period from January 3 to April 26 the United States Scouting Fleet, consisting of the dreadnoughts *Wyoming, Delaware, Utah* and *North Dakota,* two destroyer squadrons, submarine divisions, air force and the fleet train, manned by 15,000 officers and men, and commanded by Vice-Admiral John D. McDonald, engaged in its annual period of training and maneuvers in southern waters.

The training consisted of day battle practice with 12-inch and 5-inch guns for the dreadnaughts at ranges in excess of 20,000 yards, night anti-destroyer practice, anti-aircraft and torpedo practice, and for the destroyers, of torpedo firing and practice with their 4-inch guns. The submarines played their part in the fleet maneuvers on the surface and submerged, the aircraft in addition to making numerous flights and reconnaissances spotted for the day practices of the long-range guns, and last but not least the ships of the train carried and furnished the fleet with coal, oil and provisions during the long stay.

The latter part of February and the month of March were spent in Panama, where the Scouting Fleet took part in joint maneuvers with the Battle Fleet, from the Pacific Coast.

Nor was the work of the personnel confined to the training of the ships as units, and as integral parts of the fleet. Every moment of every working day of the stay in Guantanamo Bay, not spent in maneuvers or big-gun practice, was devoted to instructing the officers and men in the elementary details of their profession. Seamanship, rowing, sailing, swimming and athletic contests of all kinds occupied the time, and as the records given below show, the subject of small arms marksmenship was by no means neglected.

It is a well-known fact that training in rifle shooting is of the greatest benefit to the pointers of the big guns of the Navy and it is almost an invariable rule that a good gun pointer is a good rifle shot. Hence the showing of the fleet in small arms practice beside indicating that a large number of young Americans of the best type are being taught to shoot takes on a special significance.

During the short time that the rifle range at Guantanamo Bay, Cuba, was available, approximately 6,000 officers and men of the Fleet were fired through the various Navy rifle, pistol, and machine gun courses, and more than 5,000 of them qualified as Navy marksmen, sharpshooters, or experts.

In addition to firing the Navy courses, the 360 Marines with the fleet fired the Army rifle marksmanship course with an average qualification of 85 per cent of marksmen or better.

The Navy Rifle Range at Guantanamo Bay is one of the largest in the world with 250 rifle and 60 pistol targets. Firing can be conducted at all ranges at the same time with a minimum of interference, and two thousand men may be fired over the Navy Marksman's Course in one day without straining the capacity of the range.

In addition to the regular instruction and record firing, the Aukland Cup Match, the Fleet Rifle Match, and the Officers' Individual Pistol Match were held, and a tryout given to candidates for the Navy Rifle Team as a result of which fifteen officers and men were recommended as team material.

On August 12, 1908, on the occasion of the rifle match between the fleet rifle team and a team from the Aukland District Volunteers, a cup was presented by the Association on behalf of the citizens of Aukland, New Zealand, to be held as a trophy for rifle competitions in the United States Atlantic Fleet. This cup is competed for annually by teams of six officers from each capital and auxiliary ship, each destroyer division, and each submarine tender with attached submarines.

This year the match was fired on April 18, with six teams competing. The match started with changing positions fire in which each competitor fired four strings. For a string the target is exposed five times and the firer fires one shot at each exposure. The target is exposed five seconds, and five seconds elapse from its disappearance to its appearance again. The sequence of positions is: Prone, kneel, squat, sit, prone. After firing the first shot in the prone position the firer kneels for the second shot, squats for the third shot, sits for the fourth shot and lies down for the fifth shot.

The slow fire consists of 5 shots in each of the following positions: Prone, kneeling, squatting and sitting. All firing is at 500 yards.

At the end of the changing position fire the three high scores were Utah 333, Delaware 325, and Savannah 322.

The Utah team made a hard fight for first place but the steady slow fire shooting of the Delaware team drew it slowly but surely ahead until at the finish it was leading by 14 points.

The detailed scores are given below:

AUKLAND CUP MATCH

U. S. S. *Delaware*	782
U. S. S. *Utah*	768
U. S. S. *Savannah*	736
U. S. S. *Wyoming*	716
Twenty-seven Destroyer Division	684
U. S. S. *North Dakota*	652

On April 19 the Fleet Rifle Match was held. All ships and units eligible to compete for the Aukland Cup are authorized to enter teams in this match. The winner receives the Department Small Arms Marksmenship Cup.

The teams consist of eight members, not more than two of whom may be officers.

The firing is the same as for the Aukland Cup, with the addition of a skirmish run.

In this match the North Dakota took the lead in the first stage and held it throughout, though at the end of the skirmish it looked like anybody's match with the Delaware only six points behind.

The surprise of the match came in the last stage, slow fire, when the Wyoming overcoming a lead of 33 points passed the Delaware, taking second place with one point to spare.

FLEET RIFLE MATCH

U. S. S. *North Dakota*	1,869
U. S. S. *Wyoming*	1,849
U. S. S. *Delaware*	1,848
U. S. S. *Utah*	1,825
U. S. S. *Savannah*	1,664
Twenty-seven Destroyer Division	1,510

The third match to be held was the Officers' Individual Pistol Match with the service pistol. It is held each year, and five cash prizes are awarded "to encourage officers to become expert in the use of the automatic pistol."

The match consists of two seven-shot strings slow fire, and two rapid-fire strings 30 seconds per string at 50 yards, two strings 30 seconds per string and two strings 15 seconds per string at 25 yards, all on the A target.

In this match there were 42 entries and as is shown by the score it was hotly contested. Bartlett, Smith and Culpepper, all finishing with 252 out of a possible 280. The tie was decided first by the highest total rapid-fire score, second by the highest rapid-fire score at 50 yards.

OFFICERS' INDIVIDUAL PISTOL MATCH

Bartlett, B. (Ensign, USN)	252
Smith, J. C. (Major, USMC)	252
Culpepper, R. W. (1st Lt. USMC)	252
Thompson, H. L. (Lt. USN)	245
Knapp, R. A. (Ensign, USN)	239
Weems, P. V. H. (Lt. Comdr. USN)	238
Sackett, E. L. (Lt. jg. USN)	237
Gardner, E. R. (Ensign, USN)	235
O'Connor, J. (Lt. jg. USN)	235
DeLashe, M. B. (Lt. jg. USN)	230
Ferguson, R. A. (Lt. (DC) USN)	229
Pratt, H. B. (Major, USMC)	226
Stahlberger, A. (2nd Lt. USMC)	226
Bogart, I. C. (Comdr. USN)	221
Waggener, R. S. (Ensign, USN)	221
Sterling, P. R. (Lt. jg. USN)	220
Hunter, G. P. (Ensign, USN)	219
Breed, G. G. (Lt. USN)	219
Metzel, J. C. (Lt. USN)	218
Cloud, B. W. (Lt. NSN)	217
Wilson, G. B. (Lt. (MC) USN)	215
Meigs, J. F. (Comdr. USN)	214
Register, P. J. (Ensign, USN)	209
Wray, H. T. (Ensign, USN)	205
Cox, J. J. (Gunner, USN)	200
Brandt, E. S. R. (Lt. Comdr. USN)	199
Sorenson, K. E. F. (Machinist, USN)	196
Moebus, L. A. (Ensign, USN)	194
Hutchinson, M. C. (Ensign, USN)	193
Swanson, C. F. (Lt. jg. USN)	188
Nottekoven, J. I. (Captain, USMC)	183
Lingo, B. H. (Lt. USN)	182
Atkeson, C. L. C., Jr. (Ensign, USN)	181
Cobb, S. D. A. (Lt. USN)	178
Hall, K. R. (Ensign, USN)	176
Connor, J. (Ensign, USN)	171
Dannenmann, C. A. (Chief Boats'n USN)	164
Pratt, J. L. (Ensign, USN)	158
Darden, T. F., Jr. (Ensign, USN)	157
Collins, W. (Chief Carpenter, USN)	142
Ludlam, I. L. (Pay Clerk, USN)	109
Gary, F. B. (Ensign, USN)	100

Twenty-four candidates participated in the tryouts for the Navy Rifle Team. It consisted of firing twice over the National Match Course with 600 yards substituted for the 1,000-yard range. Within a week of the tryout most of the candidates had been straining every nerve to help drop 870-pound projectiles into a target on the high seas at 21,000 yards, and little time had been devoted to practice for this tryout. Many of them fired at rapid fire and at 600 yards for the first time. Under these conditions the showing made was considered very good, particularly as there was a nasty boiling mirage at 600 yards, coupled with a 12 o'clock fish-tail wind that would have kept the best dopester of them all guessing most of the time.

The scores for the tryout follows:

RIFLE TEAM TRYOUT

Name and Rank	*Total*
Jordan, J. M. (S. 2cl. USS North Dakota)	421
Hensler, H. K. (C.M.M. USS Delaware)	419
Gardner, E. R., Jr. (Ens. USS Wyoming)	418
Knowles, C. L. (G.M. 3cl. USS Delaware)	417
LaVelle, W. R. (C.R.M. USS Wyoming)	414
Inman, P. E. (Y. 1cl. USS Wyoming)	411
Gantzer, R. V. (W.T. 1cl. USS North Dakota)	411
Pape, W. B. (Ens. USS North Dakota)	409
White, A. L. (Cox. USS Delaware)	403
Hutcherson, R. L. (S. 2cl. USS Delaware)	403
Lingo, B. H. (Lt. USN USS Wyoming)	403
Quist, G. E. (S. 2cl. USS North Dakota)	402
Renfrew, D. W. (S.M.M. 1cl. USS No. Dak.)	401
Thompson, J. C. (S. 2cl. USS North Dakota)	397
Sorenson, K. E. (Machinist, USS Delaware)	389
Bartlett, B. (Ens. USS North Dakota)	389
Knapp, R. A. (Ens. USS Delaware)	381
Waggener, R. S. (Ens. USS Delaware)	378
Barroz, P. (M.M. 1cl. USS Delaware)	377
Lamdin, C. R. (Ens. USS Sharkey)	372
Miller, J. (B. M. 1cl. USS Wyoming)	366
Schilke, A. (Cox. USS Wyoming)	358
Belcher, C. H. (Ens. USS Sharkey)	348
Blume, B. L. (Gunner, USS North Dakota)	328

Navy Wins From Olympic Club

THE Rifle Match for the Navy Cup, presented by the Naval Training Station, San Francisco Bay, was fired at Leona Heights rifle range on Sunday, April 15, under the auspices of the California Rifle and Pistol Association.

The match resulted in a victory for Mr. Palmer's Navy Team in a tie with the Olympic Club. Under Rifle Match rules, ties are decided by the highest scores at the rapid fire stages, and the Olympic Club lost the match on this ruling.

This was the second consecutive match in which the Olympic Club and the Navy team have tied for first place as our team won the 30th Infantry Cup from the Navy Team in February on just such a tie. The crack Coast Artillery Corps team of Fort Scott was again forced into nothing better than third place, in spite of the fact that they had four of the members of the Coast Artillery Corps National Match Team which took third place in the National Team Match at Camp Perry, Ohio, last year, in competition with the best rifle shots in the United States. This speaks highly for the class of rifle shooting on this coast, demonstrating that the Pacific Coast can hold its own with the riflemen of any section of the country.

The match was an extremely close one, the issue in doubt until the very last shot had been fired. Some remarkably high individual scores were made when the disadvantages of a very difficult rifle range are taken into consideration. Major Stanley of the Coast Artillery Corps was high man with a total of 241 out of a possible 250 and within one point of the Association's record for this course. Chief Gunners Mate Flemming of the Navy was second with a total of 240, and Mr. Hansen of the Roberts Island Rifle Club, Stockton, was third with 239.

Competing in the match were 122 individuals comprising 18 teams of 6 men each. The Olympic Club individual and team scores were as follows:

FIRST TEAM

Williams	238	Rogers	232
O'Donnell	237	Randall	219
McVey	236		
Prichard	235	Total	1,397

SECOND TEAM

Milliken	226	Fahm	208
Linder	229	Jonas	187
Ashley	224		
Colborn	224	Total	1,301

TEAM STANDING

Navy Team	1,937
Olympic Club No. 1	1,397
Coast Artillery Corps	1,396
Roberts Island Rifle	1,390

Central Again Wins Astor Cup

THE Astor Cup was presented to the High School Riflemen of the country for annual competition in 1909, with the understanding that it would become the permanent property of the school winning it the most in a period of twenty years. Between 1909 and 1918 Iowa City High School captured the trophy six years. Since 1918 the Iowa City School has been displaced in four out of five competitions by Central High School of Washington, D. C., and once by an Eastern Institution, so that the final tally after the 1923 matches gives the Iowa City High School six wins and the Washington High School four, with five more years to go. There is promise of some keen competition between Iowa City and the Capital City. Central High School won the match this year after tying for first place with Modesto California High School. In the shoot off, Central High turned in seven possible, while Modesto High turned in five. Central High School Girls' Team, which won the trophy last year for the Washington Institution, finished in third place, one point below the California outfit.

ASTOR CUP MATCH 1923

Competitors	*Shoot*	*Shoot-off*
Central High School R. C. No. 2, Washington, D. C.	1000	1400
Modesto High School R. C., Modesto, California	1000	1000
Central High School, Girls R. C. No. 1, Washington, D. C.	999	
Business High School R. C., Washington, D. C.	998	
Culver Military Academy R. C., Culver, Indiana	998	
Iowa City High School R. C., Iowa City, Iowa	998	
West High School Rifle Club, Waterloo, Iowa	998	
Central High School R. C. No. 1, Washington, D. C.	997	
Central High School Girls R. C., No. 2, Washington, D. C.	997	
Western High School Rifle Team, Wahington, D. C.	997	
Evanston Township H. S. R. C., Evanston, Illinois	995	
Bangor H. S., R. O. T. C. Rifle Club, Bangor, Maine	992	
Lawrenceville School R. C., Lawrenceville, N. J.	989	
Northwestern M. & N. Academy, Walworth, Wis.	970	
DeVeaux School Rifle Club, Niagara Falls, N. Y.	940	
Pasadena High School R. C., Pasadena, California	939	
Hitchcock Military Academy R. C., San Rafael, California	937	
Flushing High School R. C., Flushing, New York	751	
Richmond Hill High School R. C., Richmond Hill, New York	No Returns	

Every Rifleman owes himself a trip to the National Matches.

Don't forget the Camp Perry dates—September 2 to September 28.

"The Dope Bag"

A free service to target, big game and field shots, all questions being answered directly by mail.

Rifles and big game hunting: Maj. Townsend Whelen.

Pistols and Revolvers: Maj. J. S. Hatcher.

Shotguns and Field Shooting: Capt. Charles Askins.

Every care is used in collecting data for questions submitted, but no responsibility is assumed for any accidents which may occur.

HIGH PRESSURE IN THE SPRINGFIELD

WOULD you consider a load of 54½ grs. of Du Pont No. 15½ powder and a 220 gr. bullet a safe and efficient load to use in a sporting Springfield in A-1 shape?

W. S. S., Los Angeles, Cal.

Answer (by Major Whelen):

The charge of 54½ grains of Du Pont I. M. R. No. 15½ powder and 220 grain Lubaloy bullet in the Springfield gives a muzzle velocity of 2,492 f. s. and a mean breech pressure of 52,940 pounds per square inch. The maximum pressure in 10 shots was 54,280 pounds per square inch. In my opinion the pressure is entirely too high for safety. While no trouble will be experienced with the very best components, a rifleman cannot always be sure that he has the best components. Take the matter of cartridge cases. The rifleman may take the precaution of getting the very best cases with rifle anneal for such a load, but even then he is not sure. The brass case is drawn from a sheet disc of brass by about 6 draws. Between each draw the cup goes to a furnace to be annealed. One case in ten thousand may stick in the furnace, and instead of being heated for 10 minutes it is heated for 20 minutes or more. That case will be softer than it should be, and if it happens to get a pressure of 54,000 lbs. on firing the chances are that it will give away, letting the gas come from the rear, demolishing the breech action of the rifle, and perhaps seriously injuring the shooter. Or, the rifleman may use a copper primer instead of a heavy brass one, and his firing pin may strike a little heavier blow than normal, or have a sharper point than normal, and the gas comes back through a pierced or blown out primer. Again, some rifleman seeing this charge recommended for the Springfield may proceed to use it in a special rifle for the Springfield cartridge having a very tight chamber such as a Niedner or Griffin and Howe barrel, with the result that he gets 60,000 lbs. pressure or over.

Du Pont No. 15½ powder has metallic tin incorporated in it to prevent lumpy metal fouling when bullets jacketed with cupro-nickel are used. Such lumpy metal fouling does not occur with any powder when bullets jacketed with Lubaloy are used, and this powder is not called for in your case. I believe it would be well to confine the use of these tin incorporated powders to cases where bullets jacketed with cupro-nickel are used. In such cases the included tin is perhaps less of an evil than the lumpy cupro-nickel fouling. I do not like to use tin incorporated powders unless absolutely necessary. Under the heat generated in the bore during the firing the tin is volatilized and goes into alloy with the surface steel of the bore. This alloy of steel (iron) and tin has a much lower melting point than steel alone, and the result is that the steel of the bore is gradually melted away, so that the barrel has a shorter life than when tin is not used. On the other hand, if cupro-nickel bullets are used with ordinary powders the resulting lumpy metal fouling probably causes injuries to the bore which are more serious than the action of the tin. For myself I prefer the regular nitro-cellulose powders without the tin, and bullets jacketed with Lubaloy or gilding metal, as with such a combination one gets away from all these troubles, and gets the maximum life from his barrel.

Under separate cover I am sending you a copy of "Cartridges and Loads," and I would recommend that you confine yourself to one of the loads recommended therein.

RELOADING FOR THE .250

I HAVE a 250 Savage in fine condition. Perfect inside in every way. I sent to the Bond Co. and got a set of tools to cast a lead bullet of very close to 86 gr. It has somewhat narrow bands and a Spitzer point, a little rounder just at the tip, one of which I send you. I get better bullets than this now; the mould has been used a little. This is one in ten for lead and tin bar. I am very careful to weigh exactly. I used by mistake nearly 13 grains of Du Pont No. 80 and the result they told me with shooting it was not being certain to get into a 12-inch ring at 100 yards actual measurement. The gun did not lead, however, at all so it seems that the bullet did not strip. I then cast other bullets, one on 7 and used 10 grains of same powder. The result, however, was not a very great deal better, as I got one three-inch bull only once out a half dozen shots, but the gun has a peep sight (rear) and a sporting sight (pretty coarse) front. Now the Bond people used a bullet sizer to push the lubricated bullet through and I am using to grease them Japan wax and sperm oil. This makes a very sticky lubricant and it leaves the sizer, grooves full and also leaves the gun after a dozen shots perfectly free from lead and very easy to clean up right with a little nitro solvent (Marble's) and clean cotton rag. From the above could you tell me if I am still using too much powder. I see by the label on the can that .25/21 85 grain bullet metal uses only 7.0 grains and the same size 86 grain lead bullet uses only 5.7 grains. I want to keep the trajectory as flat as I can. So far I have not used less than 10 grains. Will you kindly give me a further help and greatly oblige.

E. L. C., Orillia, Canada.

Answer (by Major Whelen):

I have received your letter of April 30th and have carefully examined the bullets sent. Success in reloading ammunition depends upon the skill and knowledge of the individual and the pains taken. A complete outfit of good tools are necessary. The cartridge must be well made and uniform to get accuracy. The bullet must be perfect at the start, and it must still be perfect after it is seated in the case.

The two bullets sent show that either the mould was not properly broken in, or that it was not hot enough when casting. One bullet apparently is not resized and measured .263". This is entirely too large. The other bullet, apparently, has been forced through some kind of a sizer, and measured .257". This is too small. The resizing is not uniformly done. As a result of the mould not being broken in or not being hot enough, the bands on the bullet are not full. Thus they must vary in weight and in balance. Such bullets are too imperfect for accurate work.

To make good bullets one must have some skill in casting. Such skill comes only with practice. The mould should be well broken in, and should be so hot that it takes the lead about 2 seconds to solidify in the sprew hole. The lead itself in casting must be hot. Bullets must be turned out of the mould on a soft blanket or other material, and not allowed to bump into each other or fall or roll on a hard surface so that they will deform. In other words, the bullets must be perfectly cast. For the .25 caliber with smokeless powder an alloy of ten parts of lead to one of tin is as satisfactory as any. During moulding the alloy must be kept uniform by constantly stirring the lead in the kettle with the dipper.

Having moulded the bullets correctly, the next step is to size and lubricate them. The bore of your rifle probably measured .257", so for use with smokeless powder the bullet after sizing should measure .258". It might be sized straight and uniformly, and also uniformly lubricated. This cannot be done in a hand tool. It is foolishness and a waste of time to say that it can. I never was able to get accurate results until I got a lubricating and sizing machine. Bond makes a "Bullet Sizer and Lubricator." The die for it should size to .258". Use the stock lubricant that is supplied for the machine as it has just the right consistentcy. Too hard or too soft lubricant does not work well through the machine, and it is difficult for the individual to get hand mixed lubricant of just the right thickness.

Now, having obtained a well cast bullet, sized uniformly to the correct diameter, and properly lubricated, the next step is to prepare the cartridge case so this bullet will exactly fit in it, and not be deformed when it is seated in the case. The fired case should first be resized at the muzzle in a muzzle resizing die. Next, the sharp inside edge at the mouth of the case should be slightly chamfered off, using the reamer provided on the Bond reloading tool. Then the inside of the neck should be expanded to just the correct size for the .258" bullet with the expander plug. This expander plug should measure .25825" to allow for the spring back of the brass case. Unless all these directions are carefully followed the bullet will be deformed when seated in the case.

For powder charge, I would advise about 9 to 10 grains of Du Pont No. 80 powder. Too little powder will not give sufficient velocity to keep the bullet point on, and it will keyhole or stagger. Too much powder will give too hot a gas, which will melt the base of the bullet, thus deforming the bullet, and the melted lead may lodge in the bore, leading. Bullets do not strip except at tremendously high velocities and pressure.

In seating the bullet in the case it should not be seated too deeply. When the loaded cartridge is seated in the chamber the bullet should project so far out of the case that the lands of the rifling will very slightly mark the ogive of the bullet.

I feel sure that somewhere in these directions you will find the causes for your troubles. What I have tried to tell you is that with the beginner there are probably many causes why his reloaded ammunition does not shoot accurately. Each one of these causes of inaccuracy must be eliminated before we can make accurate ammunition.

HOW TO USE THE DOPE BAG

Address the Director of Civilian Marksmanship, and not the Dope Bag on Arms and Ammunition available for sale and prices on same.

Mark your letters at the head for the proper man, and deal only with one subject, i. e., rifles or pistols or shotguns in one letter. It is impracticable to refer letters around.

Write legibly on one side of paper only and sign name and address legibly. Almost every mail contains letters that cannot be deciphered and hence cannot be answered.

Before writing consult the various catalogues and ballistic tables published by manufacturers. Much information can be obtained from them as well as from standard books and publications of the N. R. A.

CHARGES AND ELEVATIONS

I HAVE a 45-90 mod. 1886 Winchester take-down rifle with 26-inch barrel and full magazine. When the rear sight is properly adjusted for the regular Winchester smokeless s. p. 300 gr. cartridge, the high velocity cartridge, same make, shoots a full 8 inches high at 100 yards. I would like to use both cartridges in the rifle without adjusting the rear sight when changing from one to the other, but the difference of 8 inches at 100 yards in the shooting of the two cartridges will not permit this.

In your book, "The American Rifle," you give a load for the 45-90 developing a velocity of 2,350 f. s. with the 300 gr. bullet, the powder charge being 68 grains of No. 16. I would like to use this load in my rifle also, but I imagine that this load would throw the bullets about two feet high at 100 yards. What has been your experience in this respect? Also what is the cause of such a big difference in the shooting of the two cartridges, the regular smokeless and the H. V., when the difference in velocity is only about 400 f. s.? My 30-40 mod. 1895 Winchester rifle has the rear sight set for the standard cartridge, 220 gr. bullet, 200 f. s., yet I do not have to readjust the rear sight when using a cartridge developing, probably, in the neighborhood of 3,200 f. s. velocity, the shooting being only about 2 inches high at 100 yards, which is satisfactory.

The high velocity cartridge I have been using in my 30-40 is one that I reload with 46 grs. of No. 16 and the 32-20 115 gr. Winchester metal cased bullet. It's a load with a loud report, but not the best accuracy. Now, there is a difference in velocity between this cartridge of the loud report and the 30-40 220 regular of about 1,200 f. s., but I do not find it necessary to alter the rear sight when changing from one to the other.

Which fact leads me to believe the barrel of my 45-90 is a defective one, and that the high shooting of same with the H. V. cartridge is, I would judge, about 5 or 6 inches higher than a normal barrel would shoot. Kindly give all information you can regarding the matter.

In the fall of 1917 I read an announcement in Outer's Recreation that an article was to appear in that magazine, written by you, entitled "How a Winchester or Any Other Rifle Can Be Made to Shoot as Accurately as a Target Rifle," or something like that. I missed that article, and have often wondered what it contained.

A. W. E., Biwabik, Minn.

Answer (by Major Whelen):

The matter of different charges shooting with different elevations is readily explained. All rifles fired from the regular stock and supported by the shoulder against the butt plate below the line of axis of bore vibrate or jump when fired. The barrel first vibrates downward, and then of course vibrates upward, going through a number of vibrations like a tuning fork. The bullet usually departs from the muzzle during one of the upward vibrations. The higher the breech pressure the more extensive the vibration. On account of the breech pressure the upward vibration with a high velocity cartridge is much greater than with a low velocity cartridge, and as the barrel is practically bent upward the high velocity cartridge strikes higher on the target. Muzzle velocity has relatively little to do with this at short ranges compared with breech pressure. I think you will see that this explains practically everything in your letter. There is no way to get away from this except by using a short, very heavy barrel, which of course will vibrate much less than the ordinary barrel, but such a barrel would make the weapon entirely too heavy for hunting.

As an example of this, take the usual high power rifle with light barrel. For reduced loads at 50 yards such a rifle requires the sights to be set at about the elevation required for the high power load at 450 yards.

I do not recollect ever writing an article on how to make Winchester rifles or similar rifles shoot as accurately as target rifles. It cannot be done, although often great improvement can be made in these light lever action hunting rifles by carefully fitting the ammunition to the particular barrel and chamber. My book, "The American Rifle," explains the principles very fully, as also does the serial on reloading by Mattern now running in the "American Rifleman."

BALLISTITE POWDER

Ime some information about the well known dense amokeless powder, "Ballistite." Are there two kinds SHOULD be greatly obliged if you will kindly give of this powder, viz., one for shotgun shells and one for rifles? I use it in shotgun shells and have heard that the Russians used it in their military rifles; also I opened some 7mm. rifle shells of German or Austrian make and found what appeared to be Ballistite loaded in them. I have some empty primed Winchester shells (.303 British) and some 215 gr. soft-nosed bullets for same. Could I take the Ballistite out of some Arrow shells and load the .303 rifle cartridges with it. In an old Marlin catalogue I have, dated 1909, it warns anyone from loading shotgun powder into rifle shells, but if there is only one kind of Ballistite this then I think, would not apply to such warning. When a person is living in a very remote and out of the way place, to know what powders he could use to reload both shot and rifle shells is mighty useful, as he could always order that one particular powder. What pressure, energy and velocity would be obtained in a '06 Springfield rifle or .303 British rifle using the same charge of Ballistite as the ordinary "Arrow" Remington shell is loaded with, that is of course if such can be done. The 12-gauge shell 2¾-inch contains 22 or 24 grains Baliistite powder. I read with the greatest interest your article on the .375 Holland & Holland Magnum rifle, and agree that the price is very excessive. I would like to own such a gun, but in these times the cost is too great. If one of the American big firms would build a gun of this caliber and power I believe there would be a good demand, especially if the price was in the vicinity of $75 or a little less, besides there would be the great advantage of getting reloading tools which no British gunsmiths make or seem to know anything about. I think your splendid article will make many American sportsmen ask for such a rifle of this power; I hope so, as then I might be able to possess one. Would the recoil be too severe if fired in the prone position? In your reply to E. N., St. Louis, you mention about a new rifle that you have designed. Am I right in guessing that it is on the lines of the .375 Magnum? I would dearly love to hear of the particulars, or if you would print same in "The American Rifleman" as a great number of its hunter readers would also like to know about it. I am a new subscriber, but I have read your articles in "Out Door Life" for years and greatly liked them, but this is the first time I have approached you direct, but you will, no doubt, be pleased to hear that you have a great admirer in the tropical islands of the South Pacific.

W. W., Vanua Levu, Fiji.

Answer (by Major Whelen):

Ballistite powder is made in the United States only for shotguns. In Europe I believe they make it for both shotguns and rifles, but these two powders differ materially, just as Du Pont makes several kinds of shotgun powders, and a number of kinds of rifle powders, all differing materially and all having their special uses. In Europe most of the rifle powders are square flaked, appearing like Ballistite but most of them are not.

I want to make it very emphatic to you that it is entirely unsafe to use shotgun Ballitite in full charges in rifles. This powder is entirely unsuited for such use, although rifle Ballistite, which is made to give an entirely different rate of burning, although with similar grain, may be all right. Shotgun Ballistite may, however, be used for reduced loads in rifles. I should say that in modern military rifle cartridges the charge should not exceed eight to nine grains weight.

When Mattern's articles on reloading are published the tables of charges will doubtless be assembled in one place in the book. Under separate cover I am sending you copies of "Cartridges and Loads" and "Cleaning of Modern Firearms." In the first mentioned booklet you will find some notes on powder which may be of some use to you.

SIDEL AND FECKER SCOPES

WOULD you kindly give me some advice on scopes? I have a chance to get a Sidle at a reasonable figure. It is a very clear sight; don't know what power. The object end is ⅞ tube and the eyepiece end is ¾. Will it stand the vibration of the Springfield?

How would the Fecker 8 x scope do for woodchuck shooting, the one he lists at $22.50?

(I will use scope in mounts of my own make, rigid mount with scope sliding freely without lost motion. Elevation and windage with the Lyman No. 48.)

T. R. G., Williamsport, Pa.

Answer (by Major Whelen):

The Sidel telescope was a most excellent glass in the days of black powder. I do not know of any better telescope sight made 20 years ago, but in those days smokeless powder in high power rifles was being used very little. This telescope was not made with any idea of standing great recoil and vibration of such rifles. On the Springfield you will find that your eye has to be placed so near to the telescope to obtain the proper field of view when the rifle recoils the eye will probably be struck by the eyepiece of the telescope, also after a little use you will probably find that the lenses in the Sidel telescope will become loose from recoil and that then the telescope will be anything but secure.

On the other hand, the Fecker telescopes are most modern and excellent in every way and I can thoroughly recommend them.

You speak of using a mount of your own, in which you will have elevation and windage with the Lyman No. 48 sight. I would like to caution you about this. The Lyman No. 48 sight is all right as a metallic sight because the front and rear sight are about 30 inches apart, but with a modern telescope your two mountings will be only about seven inches apart. With the Lyman 48 sight used as it was intended, one minute in elevation or one click in windage equals one inch on the target. If you use it with the telescopic mountings only about seven inches apart one click or one minute on it will be equivalent to about five inches at 100 yards, that is with this sight you cannot adjust your telescope to shoot closer than five inches to where you want it to at 100 yards; in other words, you place an instrument of precision on your rifle and then are unable to use it on account of the way you mount it. I would strongly advise using the Winchester mountings, including the No. 2 rear mount.

PRESSURES IN THE MOD. '95

WOULD you kindly let me know what, in your estimation, is the maximum allowable breech pressure for the model '95 Winchester sporting rifle?

I bought one a few months ago for no other reason that that you, in The American Rifle, 1918 edition, pages 486 to 488, say that it has "the old-fashioned, clean pull" and that the bolt-action trigger pull "never satisfies one as well as the straight, clean pull, especially in rapid fire." Now I find that the trigger pull on the '95 cannot be reduced with safety to less than about 4¼ lbs. and I like to shoot with about 3 lbs. Furthermore, I find that you in the reloading manual give this rifle only 45,000 lbs. safe breech pressure. Although my rifle is chambered for the .30-06 I thought it is the same action that is safe for the .405 Winchester, supposed to be the most high-powered cartridge made in the U. S.

I do not mind what you say on page 47 about the action shooting loose. It is not a question of expense for ammunition, nor of the rifle lasting forever, but of safe shooting with the 220 grain bullet, and possibly stepping up the speed of this latter bullet, that I am very much interested in your opinion of safe breech pressures. Other motives for buying this gun were the straight feeding of soft-nosed 220-grain bullets, and the speed of the repeating action, all as you see for strict hunting purposes.

I own and use a Springfield .03 (trigger pull 3 lbs.) but thought of improving on strictly hunting points. It seems to me that I have reasons now to be disappointed.

E. S., Brooklyn, N. Y.

Answer (by Major Whelen):

The Winchester model '95 rifle in caliber .30-06 should be perfectly safe with cartridges giving a mean pressure of not more than 53,000 lbs. per square inch. A mean pressure of 45,000 pounds should not be exceeded in this rifle using the .30-40 and .35 W. C. F. cartridges, as the heads of these cartridges are larger than in the case of the .30-06, and consequently a larger portion of the breech pressure is exerted in back thrust on the bolt head. A pressure of 45,000 lbs. is also usually given for the .405 W. C. F. cartridge, but personally I think this might be exceeded a little, as with a straight case like this there is more friction or drag of the walls of the case on the walls of the chamber, and not so much backthrust, as in a tapered or necked case.

With high pressures around, say, 52,000 lbs. in the Winchester model '95 rifle, I would expect that several thousand rounds fired would result in a permanent setback to the breech belt, enlarging the headspace somewhat. This because all of these commercial actions are made of a relatively soft steel as compared with military bolt actions, not heat treated, to reduce the cost of production. This soft steel gives on pressure, and finally develops a permanent set. The hard heat treated steel of the receiver and bolt of the Springfield '03 does not give, and one breech action will outwear many barrels with no change whatever. However, this characteristic of the model '95 need give you no concern, as before the rifle became at all unsafe the condition would manifest itself by the cartridge case separating or splitting in two pieces just in front of the head through excess head space. The owner of the rifle would then of course send his rifle back to the Winchester Company to have it tightened up by the substitution of new and tighter breech bolt and locking bolt.

Relative to the trigger pull, I have two model '95 rifles in which the trigger pull has been reduced to about 3¼ pounds. On one of these I reduced the pull to two pounds, but found the hammer would not remain cocked when the action was operated rapidly. By being very careful to cut the notch in the hammer and the sear absolutely square I found that it was possible to get down to about 3¼ pounds with perfect safety. By all means be very careful about this and test your trigger many times, working the mechanism as rapidly and as hard as you possibly can, seeing that the hammer surely stands, for a falling hammer is a very dangerous thing.

I can see no reason why the Winchester model '95 should not be a very satisfactory rifle for your purpose. In fact, it is a most excellent rifle. It is probably freer from jams than any other lever action rifle. At the same time we must realize the fact that these rifles having the breech bolt supported at the rear end, like the model '95 and the Lee-Enfield, are not quite as accurate as those having the bolt supported at its head, like the Springfield, Mauser, and Mannlicher, other conditions as to barrel, ammunition, etc., being the same.

A springy action, like American lever actions, permits the case to stretch, due to the breech bolt springing back, and it is very difficult to properly resize such cases for reloading. These springy actions have plenty of margin of safety. The metal springs instead of breaking, with extremely excessive loads, these lever actions give way, not by the cracking or shearing of the breech bolt, but by the walls of the receiver spreading at the rear.

To sum up, there is no reason that I know of why you should not use your Winchester model '95 for heavy charges, with the 220 grain bullet, provided these charges do not exceed those recommended in the booklet, "Cartridges and Loads for American Rifles"—that is, do not exceed a mean pressure of 53,000 lbs. per square inch.

HUNTING IN OLD MEXICO

I AM contemplating a hunting trip down in "Old Mexico." I would like to get in a country where there is plenty of deer and lion and small game. My partner and I will go on motorcycles and sidecars. About September 1 is when we set to start.

I would be very grateful if you can supply some information about the hunting of this country.

I live about 30 miles south of Los Angeles. In advising me of the country in which to hunt bear this in mind as I do not want to have to go any very prohibitive distance. I have been considering the mountains of Lower California.

The guns we intend to take will be Krags cut down to sporters. How about cutting down the barrel to about 26 inches and then placing a Springfield front sight on it. With a sporting stock, with pistol grip, and these modifications, would the gun balance properly for hunting? Is this gun plenty heavy for the game we intend to run across?

What type of ammunition would you suggest as the most serviceable, or has the most stopping power, along with accuracy in the 30-40?

Any information on the game, nature of country and necessary "red tape" of such a venture would be highly appreciated.

V. L. R., Yarba Linda, Cal.

Answer (by Major Whelen):

I am sorry to say I cannot give you promise of good hunting in Mexico. Mr. Charles Sheldon is probably the most noted big game hunter in America today. He certainly knows the conditions in Mexico better than any other man. He hunted all over northern Mexico, living there for eight years from about 1896 to 1904, and has gone back on game investigation for the Biological Survey every year since. I have just concluded reading a long report of his on the game conditions in Mexico. He says that the sheep, bear, mule, deer, and antelope are practically exterminated. That the white tail deer have been killed off to such an extent that they are very difficult to get. The reason is mainly because of the enormous inroad of the automobile into Mexico in the past five years and the lack of game laws. There is much more game in Arizona than in Mexico today, but also there is more in Northwestern California than in either of these places.

The Krag rifle with barrel cut off to 26 inches and sporting stock should be excellent. It should balance and shoot finely. Use Winchester, Remington, or Western ammunition with 220 grain soft point bullet. It is heavy enough for any game.

Continued on page 28

Greater Accuracy For Your Rifle

REMINGTON UMC

OF COURSE every small bore rifleman is interested in getting the maximum of accuracy out of his rifle—but does he always go about it the right way?

There is only one way of finding out whether you are shooting the right kind of cartridges in your rifle and that is by using Remington .22 PALMA cartridges as a standard of accuracy.

SEA GIRT
JUNE 30 to - -
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Eastern Small Bore Championship Matches.

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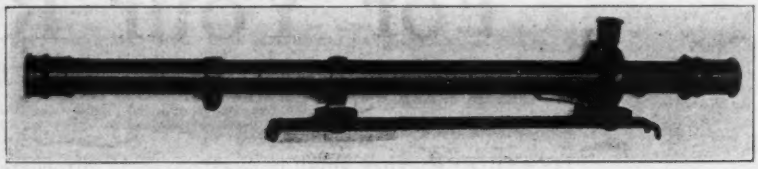
STANLEY H. CLARK
Entrance, Alberta, Canada

Another matter about Mexico. By executive order all hunting of big game in Mexico has been prohibited for ten years. I understand this does not apply to deer, but am not certain.

KNOBLE SCOPE MOUNT



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Continued from page 26

TIN FOIL IN POWDER

I HAVE experienced a little trouble with metal fouling in a 250-3000 rifle. Have also had some heavy jacketed (copper) bullets that did not seal the bore in the corners of the grooves, although the bullets measured .0005" over size of groove diam. The jackets were too hard to fill the corners. As a double remedy I have tried using metallic lead in with the powder charge. I use one grain wt. of foil (that comes around Camels) and it seems to work fine. It is deposited evenly on the bore, but possibly a bit thicker at breech. It stops metal fouling and makes a perfect seal, even with bullets a trifle small.

What do you think of the practice? Am I doing anything that might be dangerous? I would use the Du Pont powders containing metallic lead and tin but could not get them. They gave me the idea. A short time ago I read in "The Arms and The Man" the announcement of the Du Pont Co. that they had discontinued these powders on account of the success of the copper alloys. Now the Remington Co. are using a similar Du Pont powder in their match ammunition this year!

B. E. C., Harrison Valley, Pa.

Answer (by Major Whelen):

The foil which comes around cigarettes, which you are using in your powder charge, is probably made of about half lead and half tin, and it should do the work which you suggest, in cutting down the metallic fouling. During the start of the war the French Artillery used practically the same method of tin foil to reduce metal fouling in the 75-millimeter gun. I can see no objection whatever to this process, although I do not believe that it is necessary with good proper jacketed bullets. I would not increase the amount of foil over one grain, however. If you get too much of it you have a condition where the tin is volatilized and goes into alloy with the steel of the barrel. The alloy has a much reduced fusion point and gradually melts away, thus removing the steel of the bore. However, I do not believe there is any danger of this with the small amount of foil that you are using.

The Du Pont Company has not given up the manufacture of powders containing an incorporation of tin and probably will not do so as long as the ammunition companies continue to make bullets jacketed with cupro-nickel.

SPRINGFIELD RELOADS

WILL you please answer a few questions for me about reloads for the 30/06? How small a charge of Her. No. 300 can be used with the 170 grain flat base gilding metal jacket bullet and still obtain fair accuracy, and have the powder burn clean?

What is the largest amount of Lightning that can safely be used with the same bullet?

I am at present using 49 grains of Her. No. 300 with the 170 grain bullet, war time cases (U. S. C. Co.) and occasionally a primer falls out, and sometimes the gas will blow out along the left side of bolt, mashing the head of case on left side ahead about 1/64 in., caused no doubt by the gas working like a wedge, the gas being shut off on the right side by the bolt head shoulder and extractor. What do you think? The case head is also swollen, making it hard to turn the bolt. This happens about once in twenty shots. Is the pressure dangerous, that is for these cases, and about what pressure is developed with the 49 grain charge of No. 300?

Can I obtain some good cases from the D. C. M.?

A friend of mine loaded 42 grains of No. 300 in Krag cases with the 170 grain bullet; he fired three, the first two breaking about one-third of the way around in front of the head, the third one breaking clear off, just the head coming out. I tried his bolt and there seems to be too much head space. Do you think that causes the breaks. The cases are RA 17.

Are the .45 Springfields sold as new by the D. C. M. safe with commercial ammunition (not HV)?

C. S. P., Taft, Cal.

Answer (by Major Whelen):

I have a record of a charge of 31 grains Hi Vel powder and 170 grain bullet which gave a velocity of 1914 f. s. at 53 feet with clean burning. The only charges of Lightning I have for the .30-06 cartridge are given in the above booklet. Lightning is very erosive in large charges.

Forty-nine grains Hercules No. 300 is not an excessive charge when good cases are used. But the results you are getting show that the pressure is entirely too high for safety with the cases you are using. **Do not use war time cases for anything heavier than reduced loads.** Good cases can be had from the Director of Civilian Marksmanship by specifying emphatically "Cases with rifle anneal."

Forty-two grains of Hercules No. 300 powder and 170 grain bullet in the Krag is not an excessive load. When a case breaks around its circumference in front of the head it is almost always an indication of too much head space. The very poor quality of the war time cases has probably helped to cause the break. **It is not safe to use war time cases for full loads.**

The .45 caliber Springfield rifles sold by the D. C. M. are safe with black powder or low pressure smokeless loads, but not with the high velocity loads.

CLEANING REVOLVERS

I HAVE been using the Cal. .38 ball cartridges as sold by the D. C. M. but I have had much trouble in cleaning the cylinder of my Officers' Model after using this ammunition as it leaves a deposit right in front of the shell which it is almost impossible to remove. I use Hoppe's No. 9 and after cleaning the arm I leave some of this in the barrel and clean it again the next day and leave Rem Oil or some similar oil. Will you kindly advise me if you know of an easier way to clean the arm; do you think a brass bristle brush would help?

Is not the Cal. .45 Ammunition sold by the D. C. M. war time stuff? I purchased some and it has "18" stamped on the rim; does this not denote that it was loaded in 1918?

A. W. R., Punta Gorda, Fla.

Answer (by Major Hatcher):

I do not think that the cartridges have anything to do with your trouble in cleaning, for they are loaded with Bullseye, the same as most other revolver cartridges. The chances are that your revolver was left long enough at some previous time to just start rusting at this point, which is the first place to be attacked. This would cause a roughness, and would give a place for the fouling to collect and start trouble. I think that cleaning with Hoppe's, as you are doing, is as good as anything that you can do. I think that a brass brush would be excellent for use in scrubbing out the cylinder, and there is no way to do any harm with it. This fouling in the cylinder will not affect the accuracy any, as long as the cylinder is not allowed to get very badly pitted.

The .45 cal. ammunition that you describe was made in 1918. All rifle or pistol cartridges made by or for the Ordnance Department have the date stamped in this manner. All pistol ammunition, both that issued and sold at the present time, is part of the tremendous stock left at the end of the war, and much of it is excellent ammunition.

LUGER BALLISTICS

YOURS of the 19th inst. in response to my comand 9-mm. Luger cartridge received and appreci munication of May 7, relative to ballistics of 7.65 ated.

Before hearing from you the Remington Arms Company sent me their ballistic tables giving 7.65mm. Luger 93 grain bullet, muzzle velocity 1180 and energy 290; 9mm. Luger 124 grain bullet muzzle velocity 1210, muzzle velocity 400.

There seems to be so much discrepancy between the ballistics given by you on the 9mm. cartridge and that given by the Remington Arms Company that I write to inquire if there is any mistake. You give 9mm. 124 grain, muzzle velocity 1014, muzzle energy 284.

Do you know of any way of loading the 7.65mm. Luger to get higher velocity? Do you know anything as to the accuracy of the Luger carbines with 16-inch barrel, sold by the Pacific Arms Corporation of San Francisco, Calif.?

C. C. B., Newport News, Va.

Answer (by Major Hatcher):

The ballistics for the Luger cartridges, as given by me, were taken from the results of actual tests of the cartridges as made today by one of the leading ammunition companies, and agrees very closely with the figures given by several other companies.

The apparent discrepancy between these figures and those given by Remington are caused by the fact that the Remington figures for the 9mm. are based on the velocities obtained with an 8-in. barrel, while all the other figures are for a 4-in. barrel. You will see that lengthening the 4-in. barrel by four more inches only adds 200 f. s. to the velocity, or about 50 f. s. per inch of increased length. I should judge that a 16-inch barrel would give about 1400 f. s. velocity.

It is not practicable to load the 9mm. Luger Cartridge so as to get more velocity. The breech pressure of this cartridge is already very high, about 23,000 lbs., as compared to 14,000 for the .45 Colt smokeless.

I do not know anything about the Luger carbines with 16-inch barrel that you mention. I regret very much that I cannot answer this part of your question.

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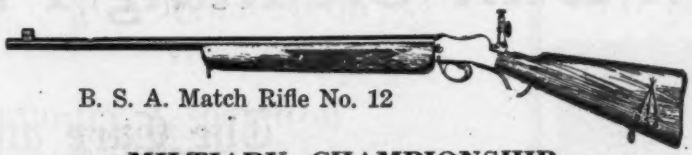

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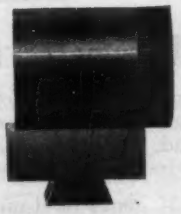

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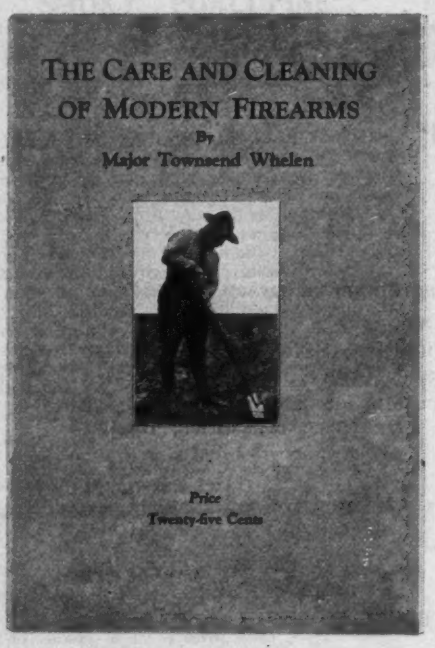

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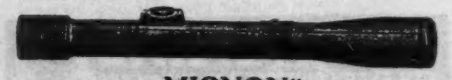

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FOR TRADE—Complete correspondence course in "Automobile Operation and Repair" for Springfield. Barrel must be good inside. Reed Miller, Sussex, Wyoming.

FOR SALE—3 Cap and Ball .44 cal. Starr Civil War Revolvers, bullet mould, nipple, wrench and directions, new, barrel bright, $8.00 each.

WANTED—Regulation Bayonet and Scabbard for .303 Short Model Lee Enfield Rifle, in good condition. Wm. F. Sattler, 514 Park Ave., Collingswood, N. J.

FOR SALE—2 cases .30-06 Springfield cartridges, never opened. First check for $32.50 each takes. F. A. Trahin, 516 Continental Ave., Detroit, Mich.

FOR SALE—.22 Winchester Musket, very accurate, fine condition, 6 power Malcolm Telescope, Winchester mounts, Lyman tang peep sight, outfit only $32.00. No trade. FOR TRADE—New 1909 D. A. .45 Colt Army, and holster for Colt .22 pistol, in fine condition. Eugene Swint, Fremont, Ohio.

FOR SALE—Winchester Model 52, restocked 13½ x1¾x3, cast off ¼ at heel and 3/8 at toe, and fitted with A-5 Scope, with No. 2 Mount. The stock is checkered and a very fine job. Outfit is brand new and in perfect condition, having been fired less than 500 times. Price $80.00, C. O. D. Thomas Shelhamer, Greenwood, Wisconsin.

FOR SALE—Winchester .22 caliber, Model 52, sling, canvas case, 2 cleaning rods, $35.00 P. O. Money Order. If not found in good condition, return. D. J. Murphy, 1790 Amsterdam Ave., New York City.

WANTED—Sharps Bochardt action, in good condition, barrel and stock immaterial. Give description and price in first letter. Ira Henderson, Box 257, Goldendale, Washington.

WANTED—S. & W. .38 Hammerless, 3¼ inch barrel. Must be A-1 condition. Priced right. A. M. Macnab, Parker Canon, Virginia.

WANTED—Large caliber S. & W. or Colt revolver or A. pistol. Must be in good condition and reasonable. Bond tools for Krag, .250-3000 and .38 S. & W. Special. Bullet S. and lubricator, also Bond moulds. Give price and details. E. E. Robinson, Box 178, Duluth, Minn.

FOR SALE—L. C. Smith Ideal grade 12-ga. auto-ejector, single trigger, 30-inch, full choke, new, $60. Winchester 3-X cross-hair scope and No. 1 mounts, $10, or will trade in on Winchester 5-A scope, cross-hair and No. 2 mounts. Heiser hand-carved chamois-lined holster for .45 Colt Auto., $2.50. Meanea basket stamped chamois-lined holster for .38 S. & W., 6-inch, $2. Both like new. Yankee pressure bullet casting machine, new, $4. One Ideal .44-40 mould and tool, new, $1.50. L. H. Wohlenberg, Iowa State Savings Bank, Lyons, Iowa.

FOR SALE—Model 1899 Savage .250-3000 lever action, good as new, and a quantity of shells—a very good buy at the price. $32.50. A. J. Welter, R. No. 1, Box 61, Crookston, Minn.

WANTED—Springfield .30 '03 either star-guaged or specially selected. Must be in perfect condition and cheap. All letters answered that include stamp. Wm. A. Schmaltz, 818 River St., Alpena, Michigan.

WANTED—No. 50 Lyman Receiver Sight for .303 Ross. S. & W .45 cal., Model 1917. Army Binoculars with Mill. Scale. Geo. M. Dreger, Camp 61, Big Creek, California.

TO CLEAR STOCK—.45 Colt Automatic $15.00; .45-1917 Smith & Wesson $19.00; .38 Smith & Wesson 6-inch Military, square butt, practically new, $19.00; .38 Colt Pocket Automatic $16.00; 4½-X Berth & Neumann, Jena, Hunting Telescope Sight with lens protector, new, $10.00; 4x20 Carl Zeiss Prismatic Monocular with leather case and shoulder strap $5.00; 8x40 Carl Zeiss, Jena, Military Field Glass Binoculars, individual eyepiece focus with case, strap and eyepiece protector $14.50; 10x27 G. Rodenstock, Munchen, Prismatic Binoculars with case and straps, central adjustment, new, $35.00; 8x27 G. Rodenstock, Munchen, Prismatic Binoculars with case and straps, individual eyepiece focus $27.50, 6x24 C. P. Foth & Co., Berlin, Prismatic Binoculars, central adjustment with case and straps, new, $21.00, Carl Shutz, Cassel, 6x22.5, Prismatic Binoculars, central adjustment with case and straps, new, $22.50; 6x30 Carl Schutz, Cassel, Prismatic Binoculars, with case and straps, individual eyepiece focus, new, $22.50. Few copies of "The American Rifle," by Major Townsend Whelen, at $4.50. .30-06 Springfield, peep on bolt, barrel about 23½ inches long $28.00. Carl Zeiss, Jena, Prismatic Binoculars, 6x24 Telex, with case and straps, new, $35.00—regular $52.50. 6x24 Hensoldt, Wetzlar, new with case and straps, $30.00. 401 Winchester Automatic, Sheard front, Lyman 52-A rear, case, $32.00. Few .22 Fiala Outfits with 3 barrels and stocks, new, $20.00. C. O. D. Parcel Post if desired. No deposit required. Field Glass made at U. S. Naval Gun Factory, with case, $12.00. Cash orders sent prepaid. No catalogue. 10 per cent discount on all American made arms. Stockbridge Sporting Goods Co., Stockbridge, Mass.

FOR SALE—Westley Richards .318 accelerated express take down Mauser. 26 inch barrel. Standard and four folding leaf rear, bead front, fine pistol grip stock with cheek piece and trap butt plate. Cartridges on stock in New York. Perfect condition. Cash $150.00—cost $250.00, pre-war. Major T. D. Sloan, Fort Bragg, North Carolina.

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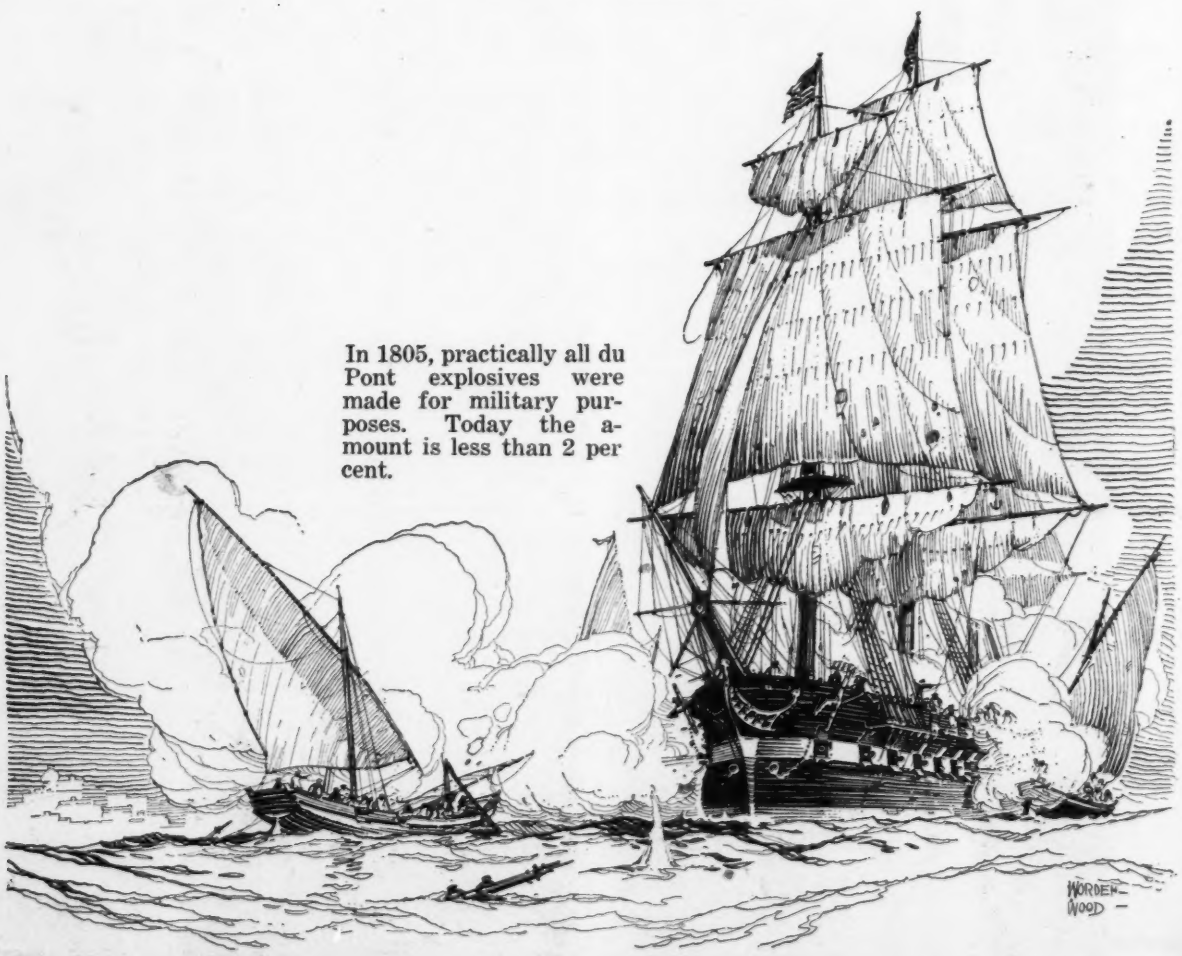

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